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DEVONIAN (FRASNIAN) RADIOLARIANS FROM THE GOGO FORMATION, CANNING BASIN, WESTERN AUSTRALIA

BY

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With 7 plates and 2 text-figures

Zusammenfassung

Aus Karbonat-Konkretionen der Gogo-Formation (West Australien) wird eine reiche und bemerkenswert gut erhaltene Radiolarienfauna des Frasnium beschrieben. Die Bearbeitung umfaßt die bisher vollständigste und besterhaltene Faunengemeinschaft des unteren Oberdevons mit 57 Arten (davon 41 neu), die 14 Gattungen zugeordnet werden. Alle hier beschriebenen Taxa sind häufig, die Fauna insgesamt wird dominiert durch Vertreter der Ceratoikiscidae (11 neue Arten). Folgende neuen Arten werden beschrieben: *Ceratoikiscum patagiatum* n. sp., *Ceratoikiscum spiculatum* n. sp., *Ceratoikiscum fragile* n. sp., *Ceratoikiscum canningense* n. sp., *Ceratoikiscum robustum* n. sp., *Ceratoikiscum marginatum* n. sp., *Ceratoikiscum echinatum* n. sp., *Ceratoikiscum torale* n. sp., *Ceratoikiscum stellatum* n. sp., *Ceratoikiscum pillaraense* n. sp., *Helenifore gogoense* n. sp., *Entactinia hystricousa* n. sp., *Entactinia gogoense* n. sp., *Entactinia aperticuva* n. sp., *Entactinia pillaraense* n. sp., *Entactinia profundisulcus* n. sp., *Entactinia proceraspina* n. sp., *Entactinosphaera australis* n. sp., *Entactinosphaera aculeatissime* n. sp., *Entactinosphaera? robusta* n. sp., *Spongentactinia concinna* n. sp., *Spongentactinia exquisita* n. sp., *Polyentactinia invenusta* n. sp., *Polyentactinia tenera* n. sp., *? Astroentactinia radiata* n. sp., *Helioentactinia stellaepolus* n. sp., *Helioentactinia aster* n. sp., *Somphoentactinia cavata* n. sp., *Spongentactinella intracta* n. sp., *Spongentactinella abstrusa* n. sp., *Seccuicollacta labyrinthica* n. sp., *Secuicollacta araneam* n. sp., *Palaeoscenidium venustum* n. sp., *Palaeoscenidium robustum* n. sp., *Palaeoscenidium echinatum* n. sp., *Palaeoscenidium nudum* n. sp., *Palaeoscenidium daktylethra* n. sp., *Palaeoscenidium tabernaculum* n. sp., *Palaeoscenidium phalangium* n. sp., *Palaeoscenidium delicatum* n. sp., *Paleotripus gogense* n. sp.

Schlüsselwörter: Radiolarien – Devon – Stratigraphie – Taxonomie – Australien.

Summary

A diverse and remarkably well-preserved Frasnian radiolarian fauna is described from carbonate concretions of the Gogo Formation, Canning Basin, Western Australia. It is the best preserved, most diverse Frasnian assemblage yet documented with 57 species (41 new) assigned to 14 genera described. All elements of the fauna are common but it is dominated by ceratoikiscids of which 11 are new species. New species described include: *Ceratoikiscum patagiatum* n. sp., *Ceratoikiscum spiculatum* n. sp., *Ceratoikiscum fragile* n. sp., *Ceratoikiscum canningense* n. sp., *Ceratoikiscum robustum* n. sp., *Ceraoikiscum marginatum* n. sp., *Ceratoikiscum echinatum* n. sp., *Ceratoikiscum torale* n. sp., *Ceratoikiscum stellatum* n. sp., *Ceratoikiscum pillaraense* n. sp., *Helenifore gogoense* n. sp., *Entactinia hystricousa* n. sp., *Entactinia gogoense* n. sp., *Entactinia aperticuvas* n. sp., *Entactinia pillaraense* n. sp., *Entactinia profundisulcus* n. sp., *Entactinia proceraspina* n. sp., *Entactinosphaera australis* n. sp., *Entactinosphaera aculeatissime* n. sp., *Entactinosphaera? robusta* n. sp., *Spongentactinia concinna* n. sp., *Spongentactinia exquisita* n. sp., *Polyentactinia invenusta* n. sp., *Polyentactinia tenera* n. sp., *? Astroentactinia radiata* n. sp., *Helioentactinia stellaepolus* n. sp., *Helioentactinia aster* n. sp., *Somphoentactinia cavata* n. sp., *Spongentactinella intracta* n. sp., *Spongentactinella abstrusa* n. sp., *Seccuicollacta labyrinthica* n. sp., *Secuicollacta araneam* n. sp., *Palaeoscenidium venustum* n. sp., *Palaeoscenidium*

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robustum n. sp., *Palaeoscenidium echinatum* n. sp., *Palaeoscenidium nudum* n. sp., *Palaeoscenidium daktylethra* n. sp., *Palaeoscenidium tabernaculum* n. sp., *Palaeoscenidium phalangium* n. sp., *Palaeoscenidium delicatum* n. sp., *Paleotripus gogense* n. sp.

Key words: Radiolaria – Devonian – stratigraphy – taxonomy – Australia.

Contents

1. Introduction

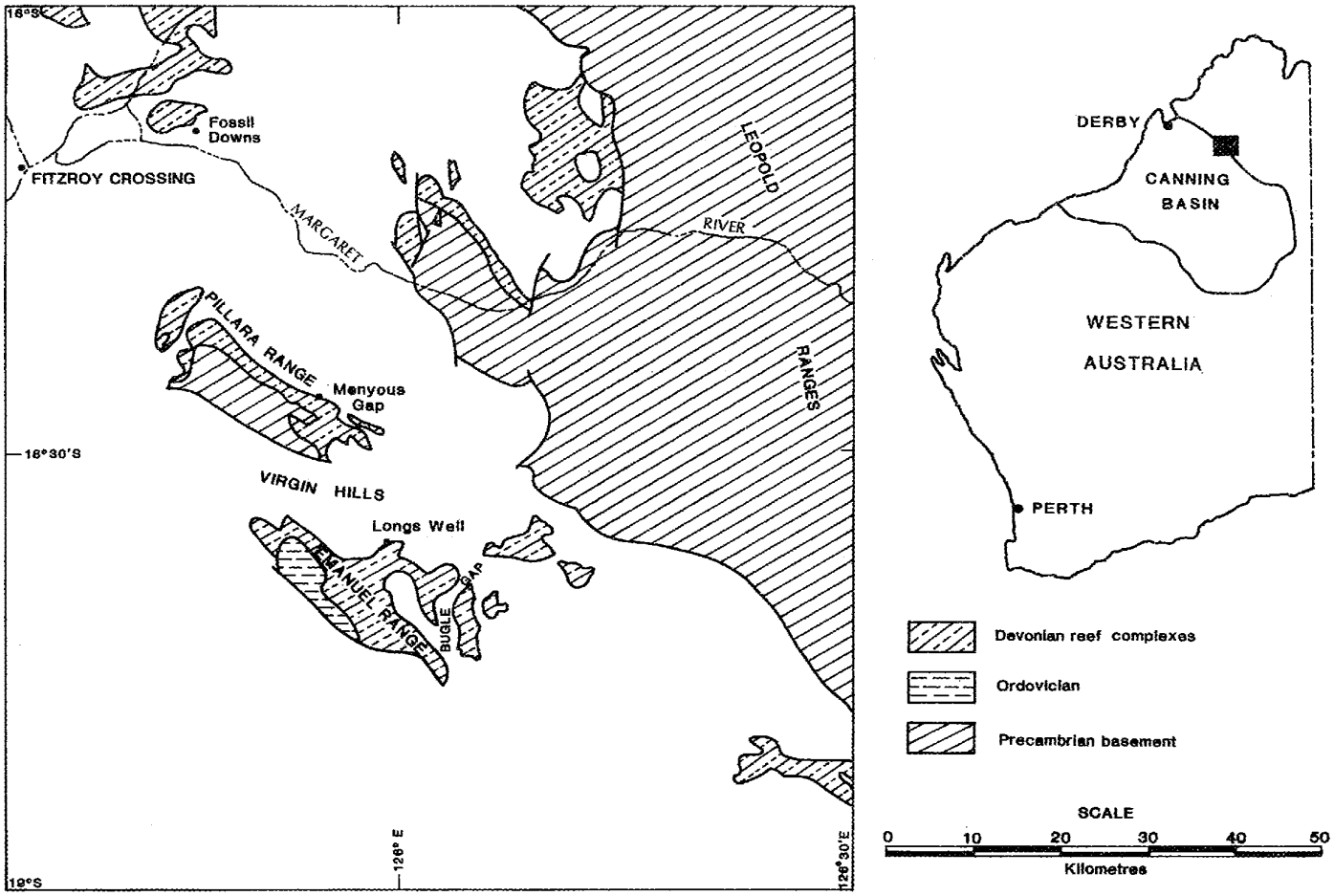
Paleozoic radiolarian biostratigraphy, particularly that of the Carboniferous to Permian is becoming increasingly detailed (HOLDSWOTH & JONES 1980, CHENG 1986, NAZAROV 1975, 1980, NAZAROV & ORMISTON 1987). Upper Devonian, Famennian, radiolarian faunas, from the northern hemisphere, have been documented in detail by FOREMAN (1963) and CHENG (1986) but Frasnian faunas are less well known. Frasnian radiolarians are well preserved at several localities in Australia. HINDE (1899) described 53 species from siliceous limestones of the Yarrimie Formation near Tamworth in NSW, eastern Australia. A Devonian age for this fauna has recently been confirmed (AITCHISON 1990). Radiolarians have also been described previously from the Gogo Formation in the Canning Basin, Western Australia (NAZAROV et al. 1982, NAZAROV & ORMISTON 1983). These radiolarian faunas all come from sample localities in the immediate vicinity of Longs Well north of Sadler Ridge (Text-fig. 1). Further radiolarian-bearing sediments have been processed by the Geological Survey of Western Australia and have yielded exceptionally well preserved lower Frasnian radiolarians from 20.5 km NNW of Longs Well in the Pillara Range southeast of Menyous Gap at 18° 25.8′ S, 125° 54.3′ E. These radiolarians are even better preserved than those described from Longs Well and their documentation will help to further refine Paleozoic radiolarian biostratigraphy. Of particular note is the exquisite preservation of fine internal detail of these radiolarians.

2. Geological setting and stratigraphy

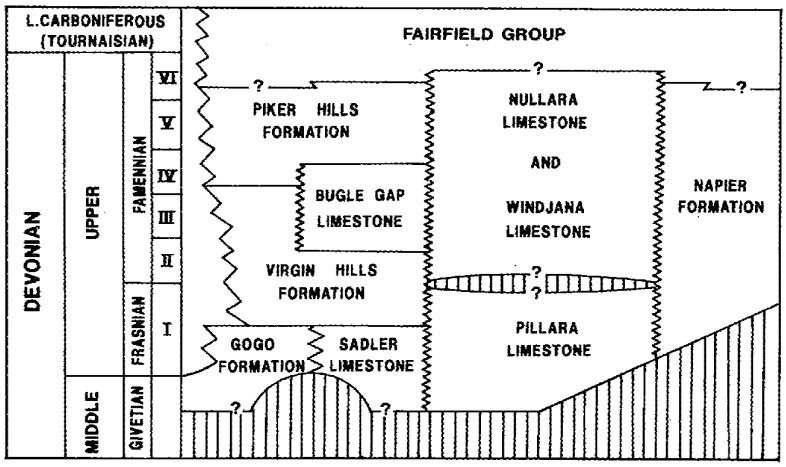
An exhumed Middle to Upper Devonian barrier reef belt crops out for over 350 km along the northeastern margin of the Canning Basin, Western Australia (PLAYFORD 1980). This area is of great significance both for studies of ancient reef systems and for the remarkably well preserved low latitude Devonian fauna and flora it contains. Reef development began in the Givetian and continued until the late Famennian when clastic sedimentation became dominant. The Gogo Formation, which contains radiolarian-bearing rocks, is a basinal succession which interfingers with marginal slope facies. It consists mainly of shale, siltstone and thin lenticular beds of limestone (NAZAROV et al. 1982). Calcareous nodules which weather out of the shales are composed of sandy micritic limestone and commonly contain well preserved fossils.

In the Pillara Range carbonate reef sediments of the Pillara Limestone grade laterally into marginal slope deposits of the Sadler Limestone which in turn grades laterally into marls of the Gogo Formation (Text-fig. 2). Basinal sediments of the Gogo Formation are conformably overlain by marginal-slope and basin facies of the Virgin Hills Formation. Detailed accounts of the Devonian geology of the Canning Basin are given by PLAYFORD & LOWRY (1966), PLAYFORD (1980) and PURCELL (1984).

The samples described all come from the Gogo Formation. No other taxa age diagnostic are known in association with the radiolarians but stratigraphic correlation indicates that at the sample locality the Gogo Formation is lower Frasnian. NAZAROV & ORMISTON (1983) mistakenly suggested that their locality was separated from the other (NAZAROV et al. 1982) Longs Well locality by over 4 km. However, these localities are



Text-fig. 1. Bedrock geology of the Pillara Range area, Canning Basin, Western Australia (modified after PLAYFORD & LOWRY 1966). Locations of radiolarian samples at Longs Well (NAZAROV et al. 1982, NAZAROV & ORMISTON 1983) and Menyous Gap (this paper) indicated.



Text-fig. 2. Generalised stratigraphy of Devonian reef complex rocks in the Canning Basin, Western Australia (modified after PLAYFORD 1980).

separated by a few 100 m at most and their stratigraphic separation may be much less than suggested by NAZAROV & ORMISTON (1983).

3. Material and methods

Radiolarians were extracted from carbonate concretions using acetic acid. Specimens are catalogued and stored in the fossil collection of the Geological Survey of Western Australia, Perth. All radiolarians described come from samples 37111 and 37149A-D from the Upper Devonian, (lower Frasnian), Gogo Formation in the Pillara Range, southeast of Menyous Gap (18° 25.8′ S, 125° 54.3′ E), Canning Basin, Western Australia.

4. Systematics

Suborder Albaillellaria DEFLANDRE 1953 emend. HOLDSWORTH 1969

Superfamily Albaillellacea CHENG 1986

Family Ceratoikiscidae HOLDSWORTH 1969

Genus *Ceratoikiscum* DEFLANDRE 1953

Type species: *Ceratoikiscum avimexpectans* DEFLANDRE 1953.

Ceratoikiscum bujugum FOREMAN 1963

Pl. 4, figs. 13, 14

1963 *Ceratoikiscum bujugum* FOREMAN p. 288–290, Pl. 8, Fig. 4, Pl. 9, fig. 9.

Description: Specimens are very close to *Ceratoikiscum bujugum* as described and figured by FOREMAN (1963). They possess six long extra-triangular rods which are all subequal in length. Rods are sturdy and circular in cross-section. A wide dense zone of patagial tissue is developed. Caveal ribs may carry numerous small spinules.

Range and occurrence: Upper Devonian (Famennian) of North America. Abundant in samples from the Gogo Formation, Upper Devonian, (lower Frasnian) Canning Basin, Western Australia.

Ceratoikiscum canningense n. sp.

Pl. 2, figs. 3, 4

Name: From the Canning Basin where this species is found.

Holotype: GSWA F44007. Upper Devonian, (lower Frasnian), Gogo Formation, Pillara Range, southeast of Menyous Gap (18° 25.8′ S, 125° 54.3′ E) Canning Basin, Western Australia.

Material: Abundant in samples from Gogo Formation, Upper Devonian, (lower Frasnian) Canning Basin, Western Australia.

Diagnosis: Five rod-like extra-triangular rods some of which may bifurcate distally. Rod b.v. is very long and directed basally with sixth and sometimes seventh shorter extra-triangular rods developed ventrally. Minor development of patagial tissue around b.v. A very strong caveal rib pair developed perpendicular to the plane of bilateral symmetry with numerous strong spines arising atop this rib.

Range and occurrence: Upper Devonian, (lower Frasnian), Western Australia so far as is known.

Ceratoikiscum delicatum CHENG 1986

Pl. 3, figs. 9–15

1986 *Ceratoikiscum delicatum* CHENG p. 78–79, Pl. 3, Figs. 2, 3, 13, 17, Pl. 4, Fig. 6, Pl. 9, Fig. 7.

Material: Abundant in samples from the Gogo Formation, Upper Devonian, (lower Frasnian), Canning Basin, Western Australia.

Remarks: Specimens figured are very similar to those figured and described by CHENG (1986). Most have six complete extra-triangular extensions although only five extra-triangular extensions are present on some specimens. Small stubby spinules are visible on caveal ribs and extra-triangular extensions of some specimens. Spongy patagium is strongly developed especially around i.v. and b.v. A single strong pair of bow-shaped caveal ribs originating from anterior portion of a.t. protrude perpendicular to the plane of bilateral symmetry. Caveal vane is developed along the central one-half of caveal rib.

Range and occurrence: Upper Devonian, Western Australia and USA.

Ceratoikiscum echinatum n. sp.

Pl. 2, fig. 8

Name: Gr., echinos, spiny.

Holotype: GSWA F44019. Upper Devonian, (lower Frasnian), Gogo Formation, Pillara Range, southeast of Menyous Gap (18° 25.8′ S, 125° 54.3′ E) Caning Basin, Western Australia.

Material: Abundant in samples from the Gogo Formation, Upper Devonian, (lower Frasnian), Canning Basin, Western Australia.

Diagnosis: Six main, strong, rod-like extra-triangular rods. Numerous other strong, secondary, extra-triangular rods developed out of a dense zone of patagial tissue which surrounds the central triangle. A pair of strong caveal ribs which curve slightly upwards are developed on a.t.

Range and occurrence: Upper Devonian, (lower Frasnian), Western Australia so far as is known.

Ceratoikiscum fragile n. sp.

Pl. 2, figs. 1, 2

Name: L., fragilis, easily broken.

Holotype: GSWA F44005. Upper Devonian, (lower Frasnian), Gogo Formation, Pillara Range, southeast of Menyous Gap (18° 25.8′ S, 125° 54.3′ E) Canning Basin, Western Australia.

Material: Abundant in samples from the Gogo Formation, Upper Devonian, (lower Frasnian), Canning Basin, Western Australia.

Diagnosis: Five long rod-like extra-triangular rods. Rod b.v. is long and strongly curved dorsally. Delicate zone of patagial tissue developed between position of missing a.a. rod and b.v. A very strong caveal rib with a delicate caveal vane atop its central one-half is developed perpendicular to the plane of bilateral symmetry at the anterior end of a.a.

Range and occurrence: Upper Devonian, (lower Frasnian), Western Australia so far as is known.

Ceratoikiscum marginatum n. sp.

Pl. 4, figs. 15, 16

Name: L., margo, border, edge, referring to the wide margin of patagial tissue.

Holotype: GSWA F44017. Upper Devonian, (lower Frasnian), Gogo Formation, Pillara Range, southeast of Menyous Gap (18° 25.8′ S, 125° 54.3′ E) Canning Basin, Western Australia.

Material: Abundant in samples from the Gogo Formation, Upper Devonian, (lower Frasnian) Canning Basin, Western Australia.

Diagnosis: Six strong rod-like extra-triangular extensions. Well-developed wide zone of patagial tissue surrounding test. Three or four strong caveal rib pairs developed along a.t. which curve in a broad arc towards b.v. Caveal rib pairs carry a caveal vane and several strong spinules which are directed dorsally.

Range and occurrence: Upper Devonian, (lower Frasnian), Western Australia so far as is known.

Ceratoikiscum patagiatum n. sp.

Pl. 3, figs. 1, 2, 16–20

Name: L., patagium, border, referring to the thick development of delicate patagial tissue.

Holotype: GSWA F43989. Upper Devonian, (lower Frasnian), Gogo Formation, Pillara Range, southeast of Menyous Gap (18° 25.8′ S, 125° 54.3′ E) Canning Basin, Western Australia.

Material: Abundant in samples from the Gogo Formation, Upper Devonian, (lower Frasnian) Canning Basin, Western Australia.

Diagnosis: Five sturdy, rod-shaped, long extra-triangular extensions. Several caveal rib pairs developed off a.t. and b.t. with well-developed hoop-shaped caveal vanes. Some caveal rib pairs, developed perpendicular to the plane of bilateral symmetry, are broadly curved towards b.v. and bear a caveal vane on top of which numerous long spinules are developed. Well-developed delicate patagium surrounding triangle with especially thick patagial tissue around b.v.

Range and occurrence: Upper Devonian, (lower Frasnian), Western Australia so far as is known.

Ceratoikiscum pillaraense n. sp.

Pl. 4, fig. 11

Name: From the Pillara Range where this species is found.

Holotype: GSWA F44035. Upper Devonian, (lower Frasnian), Gogo Formation, Pillara Range, southeast of Menyous Gap (18° 25.8′ S, 125° 54.3′ E) Canning Basin, Western Australia.

Material: Abundant in samples from the Gogo Formation, Upper Devonian, (lower Frasnian) Canning Basin, Western Australia.

Diagnosis: Test with six well-developed extra-triangular rods which meet to form a small triangular area. Position of i.d. and a.p. rods very close to each other. Several short delicate caveal rib pairs developed along the anterior end of a.t. A very wide well-developed zone of patagial tissue surrounds the central triangle.

Range and occurrence: Upper Devonian, (lower Frasnian), Western Australia so far as is known.

Ceratoikiscum planistellare FOREMAN 1963

Pl. 4, figs. 1–5

1963 *Ceratoikiscum planistellare* FOREMAN p. 290, Pl. 8, Fig. 6, Pl. 9, Fig. 8.

Material: Abundant in samples from the Gogo Formation, Upper Devonian, (lower Frasnian) Canning Basin, Western Australia.

Description: Specimens assigned to this species have five sturdy extra-triangular rods. A central skeletal frame which is triangular. Strongly developed patagium, Several pairs of ribbon-like caveal ribs carried by a.t. and b.t. meeting again below i.t.

Range and occurrence: Upper Devonian (Frasnian) of the Western Australia and the southern Urals, (Famennian) of North America.

Ceratoikiscum robustum n. sp.

Pl. 4, figs. 8, 12

Name: L., robustus, strong, referring to the well developed caveal ribs.

Holotype: GSWA F44015. Upper Devonian, (lower Frasnian), Gogo Formation, Pillara Range, southeast of Menyous Gap (18° 25.8′ S, 125° 54.3′ E) Canning Basin, Western Australia.

Material: Abundant in samples from the Gogo Formation, Upper Devonian, (lower Frasnian) Canning Basin, Western Australia.

Diagnosis: Six strong rod-like extra-triangular extensions. Well-developed dense patagial tissue around ventral portion of test outside of triangle. Two strong caveal rib pairs developed near the dorsal end of a.t. Caveal ribs curved in a broad arc towards b.v. and each bears several small spinules developed on the dorsal side.

Range and occurrence: Upper Devonian, (lower Frasnian), Western Australia so far as is known.

Ceratoikiscum spiculatum n. sp.

Pl. 3, figs. 3–8

Name: L., spicula, point, referring to the numerous long spinules.

Holotype: GSWA F43992. Upper Devonian, (lower Frasnian), Gogo Formation, Pillara Range, southeast of Menyous Gap (18° 25.8′ S, 125° 54.3′ E) Canning Basin, Western Australia.

Material: Abundant in samples from the Gogo Formation, Upper Devonian, (lower Frasnian) Canning Basin, Western Australia.

Diagnosis: Six long extra-triangular extensions which are often curved towards their distal end. Long spinules commonly developed near the end of extra-triangular extensions. Moderate development of a delicate patagium between a.a., b.v., and a.p. but it is absent along a.t. Several long curved ribs carried by a.t. and b.t.

Range and occurrence: Upper Devonian, (lower Frasnian), Western Australia so far as is known.

Ceratoikiscum stellatum n. sp.

Pl. 4, figs. 6, 7, 9, 10

Name: L., stellatus, starry.

Holotype: GSWA F44032. Upper Devonian, (lower Frasnian), Gogo Formation, Pillara Range, southeast of Menyous Gap (18° 25.8′ S, 125° 54.3′ E) Canning Basin, Western Australia.

Material: Abundant in samples from the Gogo Formation, Upper Devonian, (lower Frasnian) Canning Basin, Western Australia.

Diagnosis: Test with seven well-developed extra-triangular rods. The seventh rod is developed immediately below a.p. slightly oblique to the axis of bilateral symmetry. Several pairs of caveal ribs are developed along a.t. A wide expanse of well-developed patagial tissue surrounds the triangle.

Range and occurrence: Upper Devonian, (lower Frasnian), Western Australia so far as is known.

Ceratoikiscum torale n. sp.

Pl. 2, figs. 5–7

Name: L., toralis, border drapery, referring to the remarkable expanse of patagial tissue.

Holotype: GSWA F44020. Upper Devonian, (lower Frasnian), Gogo Formation, Pillara Range, southeast of Menyous Gap (18° 25.8′ S, 125° 54.3′ E) Canning Basin, Western Australia.

Material: Abundant in samples from the Gogo Formation, Upper Devonian, (lower Frasnian) Canning Basin, Western Australia.

Diagnosis: Five extra-triangular rods which are circular in cross section. Two rods (b.d. and a.p.) are extremely long and the others (a.a., i.v., b.v.) are shorter and more delicate. These rods are covered by a wide and delicate expanse of patagial tissue. Several thin caveal rib pairs are developed along a.t. and b.t. rods.

Range and occurrence: Upper Devonian, (lower Frasnian), Western Australia so far as is known.

Genus *Helenifore* Nazarov & Ormiston 1983

Type Species *Helenifore laticlavium* Nazarov & Ormiston 1983.

Helenifore gogoense n. sp.

Pl. 2, figs. 9, 10

Name: From the Gogo Formation in which this species is found.

Holotype: GSWA F44025. Upper Devonian, (lower Frasnian), Gogo Formation, Pillara Range, southeast of Menyous Gap (18° 25.8′ S, 125° 54.3′ E) Canning Basin, Western Australia.

Material: Abundant in samples from the Gogo Formation, Upper Devonian, (lower Frasnian) Canning Basin, Western Australia.

Diagnosis: Two intersecting main spines (basal and apical) which join a ring of thick tissue developed off rods which form the inner circumference of the ring. A single strong secondary spine directed dorsally. Several small, thin and two larger caveal ribs directed dorsally off the side of the ring opposite to the secondary spine.

Range and occurrence: Upper Devonian, (lower Frasnian), Western Australia so far as is known.

Helenifore laticlavium NAZAROV & ORMISTON 1983

Pl. 2, figs. 11, 12

1983 *Helenifore laticlavium* NAZAROV & ORMISTON p. 464–466, Pl. 2, Figs. 8, 11, 13, 14.

Material: Abundant in samples from the Gogo Formation, Upper Devonian, (lower Frasnian), Canning Basin, Western Australia.

Remarks: Specimens are identical to *Helenifore laticlavium* NAZAROV & ORMISTON 1983. Two main (apical and basal) spines are connected across the ring by a thin rod. A secondary rod is clearly developed on the dorsal side of a wide dense spongy patagial ring. Numerous small spinules, directed basally, are developed near the base of the ventral side of the ring which bifurcates into two separate vanes ventrally.

Range and occurrence: Upper Devonian, (lower Frasnian), Western Australia so far as is known.

Suborder Spumellaria EHRENBERG 1875

Superfamily Entactiniacae RIEDEL 1967

Family Entactiniidae RIEDEL 1967

Subfamily Entactiniinae RIEDEL 1967 emend. NAZAROV 1975

Genus *Entactinia* FOREMAN 1963

Type species: *Entactinia herculae* FOREMAN 1963.

Entactinia aperticuva n. sp.

Pl. 5, fig. 4; Pl. 7, fig. 9

Name: L., apertus, open; cuvus, hole.

Holotype: GSWA F44065. Upper Devonian, (lower Frasnian), Gogo Formation, Pillara Range, southeast of Menyous Gap (18° 25.8′ S, 125° 54.3′ E) Canning Basin, Western Australia.

Material: Abundant in samples from the Gogo Formation, Upper Devonian, (lower Frasnian) Canning Basin, Western Australia.

Diagnosis: Delicate spherical lattice-shell with six long thin three-bladed main spines, subequal in width and length. Pores are typically extremely large, subcircular to subangular, variable in size and shape, with twenty or more per half a circumference. A delicate internal spicule occupies a markedly eccentric position. Two or three tiers of spinules are developed on the distal sections of the main spines, each of these tiers has three spinules, one developed on each of the ridges of the main spine. Some of the spinules are rather long.

Range and occurrence: Upper Devonian, (lower Frasnian), Western Australia so far as is known.

Entactinia gogoense n. sp.

Pl. 5, fig. 3

Name: From the Gogo Formation in which this species is found.

Holotype: GSWA F44064. Upper Devonian, (lower Frasnian), Gogo Formation, Pillara Range, southeast of Menyous Gap (18° 25.8′ S, 125° 54.3′ E) Canning Basin, Western Australia.

Material: Abundant in samples from the Gogo Formation, Upper Devonian, (lower Frasnian) Canning Basin, Western Australia.

Diagnosis: Spherical lattice-shell with seven delicate medium-length three-bladed main spines, subequal in width and length tapering to a sharp point. The pores are subcircular, variable in size and shape but generally large with twenty or more per half a circumference. A delicate internal spicule occupies an eccentric position. Short spinules are developed on the distal sections of the main spines. The spinules are subequal in length and are developed approximately the length of one spinule from the end of the main spine. Four or five spinules may be developed.

Range and occurrence: Upper Devonian, (lower Frasnian), Western Australia so far as is known.

Entactinia hystricuosa n. sp.

Pl. 5, figs. 1, 2

1982 *Entactinia additiva*? NAZAROV et al. p. 164, Fig. 3 A–D.
1988 *Entactinia additiva*? NAZAROV p. 210, Pl. 13, Fig 6.

Name: L., hystricuosus, prickly, thorny.
Holotype: GSWA F44063. Upper Devonian, (lower Frasnian), Gogo Formation, Pillara Range, southeast of Menyous Gap (18° 25.8′ S, 125° 54.3′ E) Canning Basin, Western Australia.
Material: Abundant in samples from the Gogo Formation, Upper Devonian, (lower Frasnian) Canning Basin, Western Australia.

Diagnosis: Small, spherical lattice-shell with six long strongly three-bladed main spines, subequal in width and length. The pores are subcircular to subangular, variable in size and shape, about twenty per half a circumference. A delicate internal spicule occupies a slightly eccentric position. Several tiers of short spinules are developed on the distal sections of the main spines. Each of these tiers has three spinules, one developed on each of the ridges of the main spine.

Remarks: *Entactinia additiva*? FOREMAN 1963 was described from the Gogo Formation of Western Australia by NAZAROV et al. (1982) as having "... one irregularly spherical porous shell with six heavy three-bladed main spines. Spine bases are broad, sometimes giving the impression that adjacent spines are connected with each other. In the distal part of the spines long acute spinules are developed at one or two levels. Thin rod-like by-spines occur in a few specimens. Outer shell thick, with angularly-oval pores...". They noted that similar specimens occur in the Egindinsk Formation in the Urals, USSR. Specimens described by NAZAROV et al. (1982) possess six main spines not the seven main spines of specimens described by Foreman (1963) which notably do not have spinules developed on the main spines. The species *Entactinia additiva* FOREMAN totally lacks spinules developed on the main spines, a diagnostic feature of *Entactinia hystricuosa* n. sp.

Range and occurrence: Upper Devonian, (lower Frasnian), Western Australia so far as is known.

Entactinia pillaraense n. sp.

Pl. 7, fig. 6

Name: From the Pillara Range in which the fossil was found.
Holotype: GSWA F44066. Upper Devonian, (lower Frasnian), Gogo Formation, Pillara Range, southeast of Menyous Gap (18° 25.8′ S, 125° 54.3′ E) Canning Basin, Western Australia.
Material: Abundant in samples from the Gogo Formation, Upper Devonian, (lower Frasian) Canning Basin, Western Australia.

Diagnosis: Large, spherical lattice-shell with six short strongly three-bladed main spines, subequal in width and length. The pores are subcircular to subangular, variable in size and shape, with more than twenty per half a circumference. A delicate internal spicule occupies a slightly eccentric position. A single tier of long spinules is developed at just past one half the distance along the main spines. Three spinules are developed on each main spine with one spinule developed on each of the ridges of the main spine.

Range and occurrence: Upper Devonian, (lower Frasnian), Western Australia so far as is known.

Entactinia proceraspina n. sp.

Pl. 6, fig. 1, 5; Pl. 7, fig. 1

Name: L., procerus, slender, long; spina, thorn, spine.
Holotype: GSWA F44052. Upper Devonian, (lower Frasnian), Gogo Formation, Pillara Range, southeast of Menyous Gap (18° 25.8′ S, 125° 54.3′ E) Canning Basin, Western Australia.
Material: Abundant in samples from the Gogo Formation, Upper Devonian, (lower Frasnian) Canning Basin, Western Australia.

Diagnosis: A thick spherical lattice shell with seven three-bladed main spines. One spine is significantly longer than the other. The pores are subangular and of similar size and shape with more than 50 per half circumference. A delicate internal spicule occupies a slightly eccentric position with rays from the spicule leading through to the main spines. Numerous spinules are developed off the shell.

Range and occurrence: Upper Devonian, (lower Frasnian), Western Australia so far as is known.

Entactinia profundisulcus n. sp.

Pl. 7, figs. 7, 8

Name: L., profundus, deep, sulcus, groove.

Holotype: GSWA F44068. Upper Devonian, (lower Frasnian), Gogo Formation, Pillara Range, southeast of Menyous Gap (18° 25.8′ S, 125° 54.3′ E) Canning Basin, Western Australia.

Material: Abundant in samples from the Gogo Formation, Upper Devonian, (lower Frasnian) Canning Basin, Western Australia.

Diagnosis: Robust, spherical lattice-shell with six long, strongly three-bladed, deeply grooved, main spines which are subequal in width and length. On some specimens seven main spines may be observed. The pores are subcircular and of similar size and shape, with more than twenty five per half a circumference. A delicate internal spicule occupies a slightly eccentric position. A single tier of long spinules is developed at the distal end of the main spines. Three strong spinules are developed on each main spine with one spinule developed on each of the ridges of the main spine.

Range and occurrence: Upper Devonian, (lower Frasnian), Western Australia so far as is known.

?*Entactinia* sp. 1

Pl. 7, fig. 4

Material: Abundant in samples from the Gogo Formation, Upper Devonian, (lower Frasnian) Canning Basin, Western Australia.

Description: A thick lattice shell with seven large three-bladed main spines. Pores are subrounded with more than 50 per one-half circumference. Nature of the internal detail uncertain.

Range and occurrence: Upper Devonian, (lower Frasnian), Western Australia so far as is known.

?*Entactinia* sp. 2

Pl. 5, fig. 9

Material: Abundant in samples from the Gogo Formation, Upper Devonian, (lower Frasnian) Canning Basin, Western Australia.

Description: A thick lattice shell with seven large extremely robust deeply grooved three-bladed main spines. Pores are sub-angular with more than 25 per one-half circumference. Nature of the internal detail uncertain.

Range and occurrence: Upper Devonian, (lower Frasnian), Western Australia so far as is known.

Genus *Entactinosphaera* Foreman 1963

Type species: *Entactinosphaera esostrongula* Foreman 1963.

Entactinosphaera aculeastissima n. sp.

Pl. 7, fig. 15

Name: L., aculeatus, spiny, aculeatissimus, very spiny.

Holotype: GSWA F44078. Upper Devonian, (lower Frasnian), Gogo Formation, Pillara Range, southeast of Menyous Gap (18° 25.8′ S, 125° 54.3′ E) Canning Basin, Western Australia.

Material: Abundant in samples from the Gogo Formation, Upper Devonian, (lower Frasnian) Canning Basin, Western Australia.

Diagnosis: The test has two spherical shells, six main spines and numerous, long, by-spines. The main spines are massive, approximately equal in size, and three-bladed. They have the same width along their entire length. The outer shell is thick, with rounded or rounded-oval pores. By-spines are thin, long and rod-like and tapering.

Remarks: This species is closely similar to *Entactinosphaera* cf. *E. polycanthina* figured by Nazarov et al. (1982; fig. 4D,E). However it is significantly different from the holotype of *Entactinosphaera polycanthina* from the Ohio Shale figured by Foreman (1963; pl. 4, fig. 6; pl. 6, fig. 11). It also differs from *Entactinosphaera*

echinata (HINDE) in that the by-spines are much thinner, needle-like and are more numerous. The main spines are the same width along their entire length like those of *Entactinosphaera grandis* NAZAROV and unlike *Entactinosphaera echinata* (HINDE) of Plate 5, figs. 6, 11, 14 and Plate 7, fig. 3.

Range and occurrence: Upper Devonian, (lower Frasnian), Western Australia so far as is known.

Entactinosphaera cf. *E. assidera* NAZAROV 1975

Pl. 6, figs. 2, 6

Material: Common in samples form the Upper Devonian, (lower Frasnian) Gogo Formation, Canning Basin, Western Australia.

Description: Two spherical shells with six three-bladed main spines one of which is larger than the others. By-spines short and slender. Outer shell with numerous mainly angularly-oval pores; inner shell thin with rounded pores. Delicate internal spicule occupies a slightly eccentric position.

Entactinosphaera australis n. sp.

Pl. 5, fig. 10

Name: L., australis, southern, referring to Australia where this fossil is found.

Holotype: GSWA F44037. Upper Devonian, (lower Frasnian), Gogo Formation, Pillara Range, southeast of Menyous Gap (18° 25.8′ S, 125° 54.3′ E) Canning Basin, Western Australia.

Material: Abundant in samples from the Gogo Formation, Upper Devonian, (lower Frasnian) Canning Basin, Western Australia.

Diagnosis: The test has two well-developed spherical shells, six robust main spines and numerous small very short fragile by-spines. One main spine is slightly dominant over the others. Main spines are strongly three-bladed tapering gently away from the shell. By-spines are very short, rod-like and fragile. The inner sphere is approximately one half the diameter of the outer sphere. It is moderately robust and penetrated by numerous rounded pores. The outer shell is more robust and covered by numerous small sub-angular to ovate pores.

Range and occurrence: Upper Devonian, (lower Frasnian), Western Australia so far as is known.

Entactinosphaera echinata (HINDE)

Pl. 5, figs. 6, 11, 14; Pl. 7, fig. 3

1899 *Heliosoma echinata* HINDE p. 50, Pl. 9, Figs. 1–2.
1955 *Xiphosphaera echinata* – BYOKOVA p. 68–69, Pl. 22, Figs. 4–5.
1963 *Entactinosphaera echinata* – FOREMAN p. 279, Pl. 3, Fig. 10; Pl. 4, Figs. 12a–b.
1975 *Entactinosphaera echinata* – NAZAROV p. 60–61, Pl. 3, Figs. 1–3; Pl. 4, Figs. 1–4.
1983 *Entactinosphaera echinata* – NAZAROV & ORMISTON p. 458, Pl. 1, Figs. 6–7.

Material: Common in samples from the Upper Devonian, (lower Frasnian) Gogo Formation, Canning Basin, Western Australia.

Description: The test has two spherical shells, six three-bladed main spines and numerous short rod-like by-spines. The main spines are of subequal moderate length and strongly three-bladed. The test of the outer shell is thick with numerous small angular-oval pores. Smaller three-bladed crossbeams connect through from inner shell to bases of main spines arising from the outer shell. The inner shell is delicate and possesses numerous large angular-oval pores.

Range and occurrence: Upper Devonian, Worldwide.

Entactinosphaera grandis NAZAROV 1975

Pl. 5, fig. 8

1975 *Entactinosphaera grandis* NAZAROV Pl. V, Figs. 11, 12; Pl. VII, Figs. 1–4.
1983 *Entactinosphaera grandis* – NAZAROV & ORMISTON p. 458, Pl. 1, Figs. 4–5.

Material: Common in samples from the Upper Devonian, (lower Frasnian) Gogo Formation, Canning Basin, Western Australia.

Description: The test has two spherical shells, robust main spines and rare, long, by-spines. The main spines are massive, approximately equal in size, and three-bladed. They have the same width along their entire length. The outer shell is thick, with rounded or rounded-oval pores. By-spines are rare, quite thin, rod-like and terminate bluntly.

Remarks: Closely similar to material figured by NAZAROV & ORMISTON (1983).

Range and occurrence: Upper Devonian, Worldwide.

Entactinosphaera palimbola FOREMAN 1963

Pl. 5, fig. 5

1963 *Entactinosphaera palimbola* FOREMAN p. 277, Pl. 2, Figs. 7a–e; Pl. 3, Figs. 3a–d.

Material: Common in samples from the Upper Devonian, (lower Frasnian) Gogo Formation, Canning Basin, Western Australia.

Remarks: Two spherical lattice shells with six three-bladed main spines. Two extremely well-developed strongly three-bladed main spines dominate. Thirty or forty subcircular pores of fairly uniform size per hemisphere on outer shell. Specimens with two well-developed main spines are closely similar to the specimen figured by FOREMAN (1963) on her Plate 3, figure 3c.

Range and occurrence: Upper Devonian, Worldwide.

Entactinosphaera? robusta n. sp.

Pl. 5, fig. 15

Name: L., robustus, strong.

Holotype: GSWA F44045. Upper Devonian, (lower Frasnian) Gogo Formation, Pillara Range, southeast of Menyous Gap (18° 25.8′ S, 125° 54.3′ E) Canning Basin, Western Australia.

Material: Abundant in samples from the Gogo Formation, Upper Devonian, (lower Frasnian) Canning Basin, Western Australia.

Diagnosis: One, possibly two, spherical lattice shells with six three-bladed main spines. Spines are long and of approximately equal length exhibiting some torsion. Numerous thick but short rod-like by spines. Main shell has numerous small subcircular pores.

Range and occurrence: Upper Devonian, (lower Frasnian), Western Australia so far as is known.

Entactinosphaera? cf. *E. variacanthina* FOREMAN 1963

Pl. 5, fig. 7

Material: Common in samples from the Upper Devonian, (lower Frasnian) Gogo Formation, Canning Basin, Western Australia.

Description: One, possibly two spherical lattice shells with six three-bladed spines of variable width and length. Numerous short needle-like by spines. Pores of the outer shell are subangular with twenty to thirty per hemisphere.

Remarks: Similar to specimens described as *Entactinosphaera variacanthina* FOREMAN by FOREMAN (1963: p. 278–279, pl. 3, fig. 8; pl. 4, fig. 3a–b) and NAZAROV (1975; pl. V, fig. 13; pl. VII, fig. 5, 6).

Range and occurrence: Upper Devonian, Worldwide.

Genus *Spongentactinia* NAZAROV 1975

Type species: *Spongentactinia fungosa* NAZAROV 1975.

Spongentactinia concinna n. sp.

Pl. 6, fig. 10

Name: L., concinnus, skilfully put together.

Holotype: GSWA F44057. Upper Devonian, (lower Frasnian) Gogo Formation, Pillara Range, southeast of Menyous Gap (18° 25.8′ S, 125° 54.3′ E) Canning Basin, Western Australia.

Material: Abundant in samples from the Gogo Formation, Upper Devonian, (lower Frasnian) Canning Basin, Western Australia.

Diagnosis: Large spherical shell with well-developed loose spongy layer. Several short poorly-developed main spines. Internal lattice shell well-developed with an open structure. A spicule is located eccentrically within the lattice shell.

Range and occurrence: Upper Devonian, (lower Frasnian), Western Australia so far as is known.

Spongentactinia exquisita n. sp.

Pl. 6, fig. 11

Name: L., exquisitus, choice, excellent, fine.

Holotype: GSWA F44058. Upper Devonian, (lower Frasnian), Gogo Formation, Pillara Range, southeast of Menyous Gap (18° 25.8′ S, 125° 54.3′ E) Canning Basin, Western Australia.

Material: Abundant in samples from the Gogo Formation, Upper Devonian, (lower Frasnian) Canning Basin, Western Australia.

Diagnosis: Large spherical shell with well-developed dense spongy layer. A few short rod-like main spines. Internal lattice shell well-developed with an open structure. A spicule is located eccentrically within the lattice shell. Numerous by-spines developed off the internal shell linking through to the outer spongy shell layer.

Range and occurrence: Upper Devonian, (lower Frasnian), Western Australia so far as is known.

Subfamily Polyentactiniinae Nazarov 1975

Genus *Polyentactinia* Foreman 1963

Type species: *Polyentactinia craticulata* Foreman.

Polyentactinia invenusta n. sp.

Pl. 6, fig. 9, Pl. 7, fig. 19

Name: L., invenustus, unattractive.

Holotype: GSWA F44083. Upper Devonian, (lower Frasnian), Gogo Formation, Pillara Range, southeast of Menyous Gap (18° 25.8′ S, 125° 54.3′ E) Canning Basin, Western Australia.

Material: Abundant in samples from the Gogo Formation, Upper Devonian, (lower Frasnian) Canning Basin, Western Australia.

Diagnosis: The shell has a spherical outline. The six main spines are short and rod-like. The shell wall is thin and spongy with pores of variable size and shape but generally oval. A sturdy internal spicule with six rod-like rays developed off it as the main spines.

Range and occurrence: Upper Devonian, (lower Frasnian), Western Australia so far as is known.

Polyentactinia tenera n. sp.

Pl. 7, figs. 2, 14, 18

Name: L., tenerum, delicate, soft.

Holotype: GSWA F44077. Upper Devonian, (lower Frasnian), Gogo Formation, Pillara Range, southeast of Menyous Gap (18° 25.8′ S, 125° 54.3′ E) Canning Basin, Western Australia.

Material: Abundant in samples from the Gogo Formation, Upper Devonian, (lower Frasnian) Canning Basin, Western Australia.

Diagnosis: Small, spherical shell comprising thick delicate expanse of spongy tissue. Up to six extremely long rod-like main spines arising from a sturdy centrally situated spicule. No obvious development of by-spines.

Range and occurrence: Upper Devonian, (lower Frasnian), Western Australia so far as is known.

Subfamily Astroentactiniinae NAZAROV 1975

Genus *Astroentactinia* Nazarov 1975

Type species: *Astroentactinia stellata* NAZAROV 1975.

?*Astroentactinia radiata* n. sp.

Pl. 7, fig. 13

Name: L., radiatus, rayed.

Holotype: GSWA F44080. Upper Devonian, (lower Frasnian), Gogo Formation, Pillara Range, southeast of Menyous Gap (18° 25.8′ S, 125° 54.3′ E) Canning Basin, Western Australia.

Material: Abundant in samples from the Gogo Formation, Upper Devonian, (lower Frasnian) Canning Basin, Western Australia.

Diagnosis: Small spherical shell with a thin wall and sub-rounded pores. Numerous long spines with angular oval pores at their bases and grooves along the first one-half of their length. Many small spinules are also developed. Nature of the internal details is not clear.

Range and occurrence: Upper Devonian, (lower Frasnian), Western Australia so far as is known.

?*Astroentactinia stellata* NAZAROV 1975

Pl. 6, fig. 4

1975 *Astroentactinia stellata* Nazarov p. 82–83, Pl. 8, Fig. 6, Pl. 10, Figs. 1–3.
1983 *Astroentactinia stellata* Nazarov & ORMISTON p. 459, Pl. 1, Figs. 8, 9.

Material: Abundant in samples from the Gogo Formation, Upper Devonian, (lower Frasnian) Canning Basin, Western Australia.

Description: Shell is small and spherical with a thin wall and rounded pores. Numerous main external spines which are generally short with angular oval pores at their bases.

Range and occurrence: Upper Devonian, (lower Frasnian), Western Australia so far as is known.

Genus *Helioentactinia* NAZAROV 1975

Type species: *Helioentactinia polyacanthina* (FOREMAN 1963).

Helioentactinia aster n. sp.

Pl. 7, fig. 16

Name: Gr., aster, star.

Holotype: GSWA F44082. Upper Devonian, (lower Frasnian), Gogo Formation, Pillara Range, southeast of Menyous Gap (18° 25.8′ S, 125° 54.3′ E) Canning Basin, Western Australia.

Material: Abundant in samples from the Gogo Formation, Upper Devonian, (lower Frasnian) Canning Basin, Western Australia.

Diagnosis: The test is large with two well-developed shells and numerous spines. Most spines are short, rod-like and terminate abruptly. The external sphere is thin and pierced by crossbeams which cross from the larger main spines through to the inner shell. The inner sphere is thin walled, approximately one-half the diameter of the main shell and has numerous subcircular pores. The outer shell is also thin with numerous small subcircular pores.

Remarks: Specimens are somewhat similar to *Helioentactinia perjucunda* NAZAROV & ORMISTON (1983) also from the Gogo Formation but main spines are noticeably longer on *Helioentactinia aster* n. sp. It is also somewhat similar to *Astroentactinia* sp. cf. *A. crassata* NAZAROV also from the Gogo Formation described by NAZAROV et al. (1982) p. 170, fig. 5 A. They remarked on a lack of internal detail in the specimens they studied and for that reason placed their specimens in open nomenclature. An internal shell was observed on some specimens assigned to *Helioentactinia aster* n. sp. but no internal spicule was observed within the inner shell.

Range and occurrence: Upper Devonian, (lower Frasnian), Western Australia so far as is known.

Helioentactinia perjucunda Nazarov & Ormiston 1983

Pl. 6, fig. 12

1983 *Helioentactinia perjucunda* Nazarov & Ormiston p. 460, Pl. 1, Figs. 14–16.

Material: Common in samples from the Upper Devonian, (lower Frasnian), Gogo Formation, Canning Basin, Western Australia

Description: The test is small with two well-expressed shells and numerous spines. Most spines are short, three-bladed and terminate abruptly. The external sphere is thin and pierced by crossbeams which cross from the larger main spines through to the inner shell. The inner sphere is thin walled, approximately one-half the diameter of the main shell and has numerous subcircular pores. The outer shell is thicker with numerous small subcircular pores.

Range and occurrence: Upper Devonian, (lower Frasnian), Canning Basin, Western Australia.

Helioentactinia stellaepolus n. sp.

Pl. 5, figs. 13, 17; Pl. 7, fig. 17

1982 *Astroentactinia* sp. cf. *A. crassata* Nazarov et al. p. 170, Fig. 5 A.

Name: L., stella, star; polus, pole of the earth.

Holotype: GSWA F44081. Upper Devonian, (lower Frasnian), Gogo Formation, Pillara Range, southeast of Menyous Gap (18° 25.8′ S, 125° 54.3′ E) Canning Basin, Western Australia.

Material: Abundant in samples from the Gogo Formation, Upper Devonian, (lower Frasnian) , Canning Basin, Western Australia.

Diagnosis: The test is large with two well-developed shells and numerous spines. Most spines are short and rod-like with some longer three-bladed spines also developed. The external sphere is thin and pierced by crossbeams which traverse from the larger main spines through to the inner shell. The inner sphere is thin walled, approximately one-half the diameter of the main shell and has numerous subcircular pores. The outer shell is also thin with numerous small subcircular pores.

Remarks: Similar to *Astroentactinia* sp. cf. *A. crassata* Nazarov also from the Gogo Formation described by Nazarov et al. (1982) p. 170, fig. 5 A. They remarked on a lack of internal detail in the specimens they studied and for that reason placed their specimens in open nomenclature. An internal shell was observed on some specimens assigned to *Helioentactinia stellaepolus* n. sp. but no internal spicule was observed within the inner shell.

Range and occurrence: Upper Devonian, (lower Frasnian), Western Australia so far as is known.

Genus *Somphoentactinia* Nazarov 1975

Type species: *Somphoentactinia somphozona* (Foreman) 1963.

Somphoentactinia cavata n. sp.

Pl. 5, fig. 19

Name: L., cavatus, hollowed out.

Holotype: GSWA F44050. Upper Devonian, (lower Frasnian), Gogo Formation, Pillara Range, southeast of Menyous Gap (18° 25.8′ S, 125° 54.3′ E) Canning Basin, Western Australia.

Material: Abundant in samples from the Gogo Formation, Upper Devonian, (lower Frasnian) Canning Basin, Western Australia.

Diagnosis: Large circumference thin spongy shell. No obvious spicule within the shell. Numerous rod-like spines appear to be developed off a very loose angular lattice shell-like central structure. There is no obvious development of external spines.

Range and occurrence: Upper Devonian, (lower Frasnian), Western Australia so far as is known.

Genus *Spongentactinella* NAZAROV 1975

Type species: *Spongentactinella veles* (FOREMAN) 1963; by NAZAROV 1975.

Spongentactinella abstrusa n. sp.

Pl. 5, fig. 20

Name: L., abstrusus, hidden, concealed.

Holotype: GSWA F44051. Upper Devonian, (lower Frasnian), Gogo Formation, Pillara Range, southeast of Menyous Gap (18° 25.8′ S, 125° 54.3′ E) Canning Basin, Western Australia.

Material: Abundant in samples from the Gogo Formation, Upper Devonian, (lower Frasnian) Canning Basin, Western Australia.

Description: Large thick spongy shell. Eccentrically located spicule within shell. Spicule has a short median bar with eight rays arising from either end of the bar and passing outwards to the spongy shell. Several short external spines are present.

Range and occurrence: Upper Devonian, (lower Frasnian), Western Australia so far as is known.

Spongentactinella intracata n. sp.

Pl. 6, figs. 13–16

Name: L., intracatus, complicated.

Holotype: GSWA F44061. Upper Devonian, (lower Frasnian), Gogo Formation, Pillara Range, southeast of Menyous Gap (18° 25.8′ S, 125° 54.3′ E) Canning Basin, Western Australia.

Material: Abundant in samples from the Gogo Formation, Upper Devonian, (lower Frasnian) Canning Basin, Western Australia.

Diagnosis: Large thick spongy shell. Eccentrically located spicule within shell. Spicule has a short median bar with eight rays arising from either end of the bar and passing outwards to the spongy shell. There is no obvious development of external spines.

Range and occurrence: Upper Devonian, (lower Frasnian), Western Australia so far as is known.

?*Spongentactinella* sp. 1

Pl. 7, fig. 5

Material: Abundant in samples from the Gogo Formation, Upper Devonian, (lower Frasnian) Canning Basin, Western Australia.

Description: Large, thick spongy shell. Several long slender external spines are present. Details of the internal structure are uncertain.

Range and occurrence: Upper Devonian, (lower Frasnian), Western Australia so far as is known.

Family Haplentactiniidae NAZAROV 1980

Subfamily Haplentactiniinae NAZAROV 1980

Genus *Haplentactinia* FOREMAN 1963

Type species: *Haplentactinia rhinophyusa* FOREMAN 1963.

Haplentactinia rhinophyusa FOREMAN 1963

Pl. 5, figs. 12, 16; Pl. 6, figs. 3, 7, 8; Pl. 7, fig. 11

1963 *Haplentactinia rhinophyusa* FOREMAN p. 270, Pl. 1, Fig. 2; Pl. 3, Fig. 7.

Material: Common in samples from the Upper Devonian (lower Frasnian), Gogo Formation, Canning Basin, Western Australia.

Description: Six long rod-like gently tapering spines arising from a very short median bar. Loosely developed irregular, angular lattice shell developed to a greater or lesser extent on various specimens.

Range and occurrence: Upper Devonian, Worldwide.

Subfamily Secuicollactinae NAZAROV & ORMISTON 1984

Genus *Secuicollacta* NAZAROV & ORMISTON 1984

Type species: *Secuicollacta cassa* NAZAROV & ORMISTON.

Secuicollacta araneam n. sp.

Pl. 7, fig. 12

Name: L., araneum, cobweb.

Holotype: GSWA F44079. Upper Devonian, (lower Frasnian), Gogo Formation, Pillara Range, southeast of Menyous Gap (18° 25.8′ S, 125° 54.3′ E) Canning Basin, Western Australia.

Material: Abundant in samples from the Gogo Formation, Upper Devonian, (lower Frasnian) Canning Basin, Western Australia.

Diagnosis: The framework consists of numerous rod-like rays interconnected by abundant apophyses into a dense mesh which looks like a round shell. Numerous rays extend further outwards as rod-like spines.

Range and occurrence: Upper Devonian, (lower Frasnian), Western Australia so far as is known.

Secuicollacta labyrinthica n. sp.

Pl. 7, fig. 10

Name: L., labyrinthicus, of a labyrinth, intricate.

Holotype: GSWA F44076. Upper Devonian, (lower Frasnian), Gogo Formation, Pillara Range southeast of Menyous Gap (18° 25.8′ S, 125° 54.3′ E) Canning Basin, Western Australia.

Material: Abundant in samples from the Gogo Formation, Upper Devonian, (lower Frasnian) Canning Basin, Western Australia.

Diagnosis: The framework consists of numerous rod-like rays interconnected by apophyses into an open mesh which looks like a round shell. Numerous rays extend further outwards as rod-like spines.

Range and occurrence: Upper Devonian, (lower Frasnian), Western Australia so far as is known.

Family Palaeoscenidiidae RIEDEL 1967, emend. HOLDSWORTH 1977, GOODBODY 1982, FURUTANI 1983, GOODBODY 1986

Subfamily Palaeoscenidiinae RIEDEL 1967, emend. FURUTANI 1981, 1982, GOODBODY 1986

Genus *Palaeoscenidium* DEFLANDRE 1953 emend. GOODBODY 1986

Type species: *Palaeoscenidium cladophorum* DEFLANDRE 1953.

Palaeoscenidium cladophorum DEFLANDRE 1953

Pl. 1, figs. 15–17, 19, Pl. 2, figs. 17, 20

1953 *Palaeoscenidium cladophorum* DEFLANDRE, p. 408, Text-fig. 308.
1960 *Palaeoscenidium cladophorum* – DEFLANDRE, p. 214, Pl. 1, Fig. 21.
1963 *Palaeoscenidium cladophorum* – FOREMAN, p. 302, Pl. 8, Fig. 10; Pl. 9, Fig. 6.
1973 *Palaeoscenidium cladophorum* – HOLDSWORTH, p. 128, Pl. 1, Fig. 19.
1975 *Palaeoscenidium cladophorum* – NAZAROV, p. 96, Pl. 13, Figs. 4–5; Pl. 14, Figs. 5–6.
1982 *Palaeoscenidium cladophorum* – NAZAROV et al., p. 172, Figs. 5D–F.
1983 *Palaeoscenidium cladophorum* – NAZAROV & ORMISTON„ p. 465, Pl. 2, Fig. 6–7.

Lectotype: DEFLANDRE 1953, p. 408, text-fig. 308. Lower Carboniferous, Tournaisian of France, Montagne Noire.

Diagnosis: No diagnosis was provided by DEFLANDRE (1953) who introduced *Palaeoscenidium cladophorum* as a figured specimen only.

Description: Four subequal apical rays arising at approximately 45° from horizontal. Apical rays may be subequal in length or in some specimens one ray is considerably longer than the others. Length of apical rays one-half to subequal to that of basal rays. Four tapering basal rays arising at approximately 45° from horizontal. Numerous spinules developed at right angles to basal rays below a small subquadrate tent-like structure.

Range and occurrence: Worldwide (North America, USSR, Middle Asia, Japan, Australia, England, France, Turkey) Middle Devonian to Lower Carboniferous.

Palaeoscenidium daktylethra n. sp.

Pl. 1, fig. 4

Name: Gr., daktylethra, finger sheath, thimble.

Holotype: GSWA F43979. Upper Devonian, (lower Frasnian), Gogo Formation, Pillara Range, southeast of Menyous Gap (18° 25.8′ S, 125° 54.3′ E) Canning Basin, Western Australia.

Material: Abundant in samples from the Gogo Formation, Upper Devonian, (lower Frasnian) Canning Basin, Western Australia.

Diagnosis: Four short tapering apical rays arising at approximately 45° from horizontal Length approximately one-quarter to one-third that of basal rays. Four straight, tapering slender basal rays arising at approximately 45° from horizontal. No obvious spinule development. Small thick wall circular tent-like structure developed near top of basal rays.

Range and occurrence: Upper Devonian, (lower Frasnian), Western Australia so far as is known.

Palaeoscenidium delicatum n. sp.

Pl. 1, figs. 1, 3

Name: L., delicatus, delicate.

Holotype: GSWA F43978. Upper Devonian, (lower Frasnian), Gogo Formation, Pillara Range, southeast of Menyous Gap (18° 25.8′ S, 125° 54.3′ E) Canning Basin, Western Australia.

Material: Abundant in samples from the Gogo Formation, Upper Devonian, (lower Frasnian) Canning Basin, Western Australia.

Diagnosis: Four short to medium length apical rays developed from a medial bar at a low angle to the horizontal. Four long slender rod-like basal rays commonly with a few spinules developed normal to them. A very small thin subtriangular tent-like structure is present at the top of the basal rays.

Range and occurrence: Upper Devonian, (lower Frasnian), Western Australia so far as is known.

Palaeoscenidium echinatum n. sp.

Pl. 2, figs. 14, 15, 18, 21

Name: L., echinatum, spiny.

Holotype: GSWA F43972. Upper Devonian, (lower Frasnian), Gogo Formation, Pillara Range, southeast of Menyous Gap (18° 25.8′ S, 125° 54.3′ E) Canning Basin, Western Australia.

Material: Abundant in samples from the Gogo Formation, Upper Devonian, (lower Frasnian) Canning Basin, Western Australia.

Diagnosis: Four thin apical rays one of which may be considerably longer than the others. Apical rays arising at approximately 20–30° from horizontal. Four tapering basal rays arising at approximately 50–60° from horizontal. Thin spinules profusely developed on basal rays. No obvious development of a subquadrate tent-like structure.

Range and occurrence: Upper Devonian, (lower Frasnian), Western Australia so far as is known.

Palaeoscenidium nudum n. sp.

Pl. 1, fig. 5

Name: L., nudus, bare, naked; referring to the lack of spinules and tent.

Holotype: GSWA F43980. Upper Devonian, (lower Frasnian), Gogo Formation, Pillara Range, southeast of Menyous Gap (18° 25.8′ S, 125° 54.3′ E) Canning Basin, Western Australia.

Material: Abundant in samples from the Gogo Formation, Upper Devonian, (lower Frasnian) Canning Basin, Western Australia.

Diagnosis: Four thin tapering apical rays arising at approximately 45° from horizontal. Length approximately one-half that of basal rays with which they appear continuous. Four straight, tapering slender basal rays arising at approximately 45° from horizontal. No obvious tent-like structure development and basal spines lack spinules.

Range and occurrence: Upper Devonian, (lower Frasnian), Western Australia so far as is known.

Palaeoscenidium phalangium n. sp.

Pl. 1, figs. 10–12

Name: L., phalangium, a kind of spider.

Holotype: GSWA F43986. Upper Devonian, (lower Frasnian), Gogo Formation, Pillara Range, southeast of Menyous Gap (18° 25.8′ S, 125° 54.3′ E) Canning Basin, Western Australia.

Material: Abundant in samples from the Gogo Formation, Upper Devonian, (lower Frasnian) Canning Basin, Western Australia.

Diagnosis: Four short, thin, tapering apical rays arising at approximately 20° from horizontal. Four thin basal rays arising at approximately 45° from horizontal. Spinules are abundant on basal rays. Small tent-like structure developed atop basal rays.

Range and occurrence: Upper Devonian, (lower Frasnian), Western Australia so far as is known.

Palaeoscenidium robustum n. sp.

Pl. 2, figs. 13, 16, 19

Name: L., robustus, strong.

Holotype: GSWA F43973. Upper Devonian, (lower Frasnian), Gogo Formation, Pillara Range, southeast of Menyous Gap (18° 25.8′ S, 125° 54.3′ E) Canning Basin, Western Australia.

Material: Abundant in samples from the Gogo Formation, Upper Devonian, (lower Frasnian) Canning Basin, Western Australia.

Diagnosis: Four sturdy tapering apical rays of variable length arising at 30–45° from the horizontal. Small subquadrate tent-like structure present atop four strong rod-like basal rays arising at approximately 45° to the horizontal. Strong spinules are commonly developed at 90° to three basal rays.

Range and occurrence: Upper Devonian, (lower Frasnian), Western Australia so far as is known.

Palaeoscenidium tabernaculum n. sp.

Pl. 1, figs. 2, 9, 13

Name: L., tabernaculum, tent.

Holotype: GSWA F43988. Upper Devonian, (lower Frasnian), Gogo Formation, Pillara Range, southeast of Menyous Gap (18° 25.8′ S, 125° 54.3′ E) Canning Basin, Western Australia.

Material: Abundant in samples from the Gogo Formation, Upper Devonian, (lower Frasnian) Canning Basin, Western Australia.

Diagnosis: Four apical rays two of which are short and developed horizontally. Two others are longer, curved and are developed at approximately 20° to the horizontal. Four straight, slender basal rays arising at approximately 45–60° from horizontal each with a few spinules developed at 90°. Thin well-developed quadrate tent-like structure at top of basal rays.

Range and occurrence: Upper Devonian, (lower Frasnian), Western Australia so far as is known.

Palaeoscenidium venustum n. sp.

Pl. 1, figs. 14, 18

Name: L., venustus, beautiful, elegant.

Holotype: GSWA F43965. Upper Devonian, (lower Frasnian), Gogo Formation, Pillara Range, southeast of Menyous Gap (18° 25.8′ S, 125° 54.3′ E) Canning Basin, Western Australia.

Material: Abundant in samples from the Gogo Formation, Upper Devonian, (lower Frasnian) Canning Basin, Western Australia.

Diagnosis: Four subequal, subhorizontal, slightly curved apical rays. Length one-half to subequal to that of basal rays. Four straight, slender basal rays arising at approximately 45° from horizontal. Thin spinules commonly abundant on upper one-half of basal rays emerging at 90° to main rays but may be locally curved. Small subquadrate tent-like structure may be present near top of basal rays.

Range and occurrence: Upper Devonian, (lower Frasnian), Western Australia so far as is known.

Genus *Palaeotripus* Goodbody 1986

Type species: *Palaeotripus nudus* Goodbody 1986.

Palaeotripus gogoense n. sp.

Pl. 1, figs. 6–8

Name: From the Gogo Formation in which this fossil is found.

Holotype: GSWA F43981. Upper Devonian, (lower Frasnian), Gogo Formation, Pillara Range, southeast of Menyous Gap (18° 25.8′ S, 125° 54.3′ E) Canning Basin, Western Australia.

Material: Abundant in samples from the Gogo Formation, Upper Devonian, (lower Frasnian) Canning Basin, Western Australia.

Diagnosis: Three medium length apical rays developed from a medial bar at approximately 45° to the horizontal. Three slender rod-like basal rays commonly with a few spinules developed normal to them towards their bases. A small thin subtriangular tent-like structure is present at the top of the basal rays.

Range and occurrence: Upper Devonian, (lower Frasnian), Western Australia so far as is known.

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Explanation of Plates

Plate 1

Palaeoscenid radiolarians from the Pillara Range, Canning Basin, Western Australia.
(Size of 16 mm scale bar indicated for each figure in parentheses)

Fig. 1. *Paleoscenidium delicatum* n. sp. GSWA F43976 (150 µm).
Fig. 2. *Palaeoscenidium tabernaculum* n. sp. GSWA F43977 (140 µm).
Fig. 3. *Palaeoscenidium delicatum* n. sp. (holotype) GSWA F43978 (100 µm).
Fig. 4. *Palaeoscenidium daktylethra* n. sp. (holotype) GSWA F43979 (110 µm).
Fig. 5. *Palaeoscenidium nudum* n. sp. (holotype) GSWA F43980 (140 µm).
Fig. 6. *Palaeotripus gogoense* n. sp. (holotype) GSWA F43981 (105 µm).
Fig. 7. *Palaeotripus gogoense* n. sp. GSWA F43983 (75 µm).
Fig. 8. *Palaeotripus gogoense* n. sp. GSWA F43982 (120 µm).
Fig. 9. *Palaeoscenidium tabernaculum* n. sp. GSWA F43984 (120 µm).
Fig. 10. *Palaeoscenidium phalangium* n. sp. GSWA F43985 (100 µm).
Fig. 11. *Palaeoscenidium phalangium* n. sp. (holotype) GSWA F43986 (100 µm).
Fig. 12. *Palaeoscenidium phalangium* n. sp. GSWA F43987 (100 µm).
Fig. 13. *Palaeoscenidium tabernaculum* n. sp. (holotype) GSWA F43988 (150 µm).
Fig. 14. *Palaeoscenidium venustum* n. sp. GSWA F43961 (160 µm).
Fig. 15. *Palaeoscenidium cladophorum* DEFLANDRE 1953 GSWA F43962 (80 µm).
Fig. 16. *Palaeoscenidium cladophorum* DEFLANDRE 1953 GSWA F43963 (100 µm).
Fig. 17. *Palaeoscenidium cladophorum* DEFLANDRE 1953 GSWA F43964 (110 µm).
Fig. 18. *Palaeoscenidium venustum* n. sp. (holotype) GSWA F43965 (90 µm).
Fig. 19. *Palaeoscenidium cladophorum* DEFLANDRE 1953 GSWA F43966 (600 µm).

Plate 2

Ceratoikiscid and palaeoscenid radiolarians from the Piallara Range, Canning Basin, Western Australia.
(Size of 16 mm scale bar indicated for each figure in parentheses)

Fig. 1. *Ceratoikiscum fragile* n. sp. GSWA F44004 (160 µm).
Fig. 2. *Ceratoikiscum fragile* n. sp. (holotype) GSWA F44005 (150 µm).
Fig. 3. *Ceratoikiscum canningense* n. sp. GSWA F44006 (180 µm).
Fig. 4. *Ceratoikiscum canningense* n. sp. (holotype) GSWA F44007 (180 µm).
Fig. 5. *Ceratoikiscum torale* nn. sp. (holotype) GSWA F44020 (180 µm).
Fig. 6. *Ceratoikiscum torale* n. sp. GSWA F44021 (180 µm).
Fig. 7. *Ceratoikiscum torale* n. sp. GSWA F44022 (200 µm).
Fig. 8. *Ceratoikiscum echinatum* n. sp. (holotype) GSWA F44019 (110 µm).
Fig. 9. *Helenifore gogoense* n. sp. GSWA F44024 (110 µm).
Fig. 10. *Helenifore gogoense* n. sp. (holotype) GSWA F44025 (120 µm).
Fig. 11. *Helenifore laticlavium* NAZAROV & ORMISTON 1983 GSWA F44026 (140 µm).
Fig. 12. *Helenifore laticlavium* NAZAROV & ORMISTON 1983 GSWA F44027 (140 µm).

Fig. 13. *Palaeoscenidium robustum* n.sp. GSWA F43967 (100 μm).
Fig. 14. *Palaeoscenidium echinatum* n.sp. GSWA F43968 (120 μm).
Fig. 15. *Palaeoscenidium echinatum* n.sp. GSWA F43969 (100 μm).
Fig. 16. *Palaeoscenidium robustum* n.sp. GSWA F43970 (90 μm).
Fig. 17. *Palaeoscenidium cladophorum* DEFLANDRE 1953 GSWA F43971 (105 μm).
Fig. 18. *Palaeoscenidium echinatum* n.sp. (holotype) GSWA F43972 (100 μm).
Fig. 19 *Palaeoscenidium robustum* n.sp. (holotype) GSWA F43973 (100 μm).
Fig. 20. *Palaeoscenidium cladophorum* DEFLANDRE 1953 GSWA F43974 (120 μm).
Fig. 21. *Palaeoscenidium echinatum* n.sp. GSWA F43975 (120 μm).

Plate 3

Ceratoikiscid radiolarians from the Pillara Range, Canning Basin, Western Australia.
(Size of 16 mm scale bar indicated for each figure in parentheses)

Fig. 1. *Ceratoikiscum patagiatum* n.sp. (holotype) GSWA F43989 (200 μm).
Fig. 2. *Ceratoikiscum patagiatum* n.sp. GSWA F43990 (180 μm).
Fig. 3. *Ceratoikiscum spiculatum* n.sp. GSWA F43991 (200 μm).
Fig. 4. *Ceratoikiscum spiculatum* n.sp. (holotype) GSWA F43992 (200 μm).
Fig. 5. *Ceratoikiscum spiculatum* n.sp. GSWA F43993 (200 μm).
Fig. 6. *Ceratoikiscum spiculatum* n.sp. GSWA F43994 (180 μm).
Fig. 7. *Ceratoikiscum spiculatum* n.sp. GSWA F43995 (180 μm).
Fig. 8. *Ceratoikiscum spiculatum* n.sp. GSWA F43996 (180 μm).
Fig. 9. *Ceratoikiscum delicatum* CHENG 1986 GSWA F43997 (100 μm).
Fig. 10. *Ceratoikiscum delicatum* CHENG 1986 GSWA F43998 (110 μm).
Fig. 11. *Ceratoikiscum delicatum* CHENG 1986 GSWA F43999 (140 μm).
Fig. 12. *Ceratoikiscum delicatum* CHENG 1986 GSWA F44000 (140 μm).
Fig. 13. *Ceratoikiscum delicatum* CHENG 1986 GSWA F44001 (140 μm).
Fig. 14. *Ceratoikiscum delicatum* CHENG 1986 GSWA F44002 (140 μm).
Fig. 15. *Ceratoikiscum delicatum* CHENG 1986 GSWA F44003 (140 μm).
Fig. 16. *Ceratoikiscum patagiatum* n.sp. GSWA F44008 (140 μm).
Fig. 17. *Ceratoikiscum patagiatum* n.sp. GSWA F44009 (140 μm).
Fig. 18. *Ceratoikiscum patagiatum* n.sp. GSWA F44010 (150 μm).
Fig. 19. *Ceratoikiscum patagiatum* n.sp. GSWA F44011 (160 μm).
Fig. 20. *Ceratoikiscum patagiatum* n.sp. GSWA F44012 (110 μm).

Plate 4

Ceratoikiscid radiolarians from the Pillara Range, Canning Basin, Western Australia.
(Size of 16 mm scale bar indicated for each figure in parentheses)

Fig. 1. *Ceratoikiscum planistellare* FOREMAN 1963 GSWA F44029 (120 μm).
Fig. 2. *Ceratoikiscum planistellare* FOREMAN 1963 GSWA F44030 (120 μm).
Fig. 3. *Ceratoikiscum planistellare* FOREMAN 1963 GSWA F44023 (120 μm).
Fig. 4. *Ceratoikiscum planistellare* FOREMAN 1963 GSWA F44028 (100 μm).
Fig. 5. *Ceratoikiscum planistellare* FOREMAN 1963 GSWA F44029 (45 μm).
Fig. 6. *Ceratoikiscum stellatum* n.sp. GSWA F44033 (120 μm).
Fig. 7. *Ceratoikiscum stellatum* n.sp. GSWA F44034 (140 μm).
Fig. 8. *Ceratoikiscum robustum* n.sp. GSWA F44016 (100 μm).
Fig. 9. *Ceratoikiscum stellatum* n.sp. GSWA F44031 (160 μm).
Fig. 10. *Ceratoikiscum stellatum* n.sp. (holotype) GSWA F44032 (140 μm).
Fig. 11. *Ceratoikiscum pillaraense* n.sp. (holotype) GSWA F44035 (140 μm).
Fig. 12 *Ceratoikiscum robustum* n.sp. (holotype) GSWA F44015 (90 μm).
Fig. 13. *Ceratoikiscum bujugum* FOREMAN 1963 GSWA F44013 (100 μm).
Fig. 14. *Ceratoikiscum bujugum* FOREMAN 1963 GSWA F44014 (80 μm).
Fig. 15. *Ceratoikiscum marginatum* n.sp. (holotype) GSWA F44017 (110 μm).
Fig. 16. *Ceratoikiscum marginatum* n.sp. GSWA F44018 (80 μm).

Plate 5

Entactinid radiolarians from the Pillara Range, Canning Basin, Western Australia.
(Size of 16 mm scale bar indicated for each figure in parentheses)

Fig. 1. *Entactinia hystricuosa* n. sp. GSWA F44062 (140 μm).
Fig. 2. *Entactinia hystricuosa* n. sp. (holotype) GSWA F44063 (100 μm).
Fig. 3. *Entactinia gogoense* n. sp. (holotype) GSWA F44064 (90 μm).
Fig. 4. *Entactinia aperticuva* n. sp. (holotype) GSWA F44065 (100 μm).
Fig. 5. *Entactinosphaera palimbola* FOREMAN 1963 GSWA F44036 (100 μm).
Fig. 6. *Entactinosphaera echinata* (HINDE) GSWA F44039 (275 μm).
Fig. 7. *Entactinosphaera* ? cf. *E. variacanthina* FOREMAN 1963 GSWA F44044 (110 μm).
Fig. 8. *Entactinosphaera grandis* NAZAROV 1975 GSWA F44040 (200 μm).
Fig. 9. ?*Entactinia* sp. 2 GSWA F44047 (140 μm).
Fig. 10. *Entactinosphaera australis* n. sp. (holotype) GSWA F44037 (110 μm).
Fig. 11. *Entactinosphaera echinata* (HINDE) GSWA F44041 (240 μm).
Fig. 12. *Haplentactinia rhinophyusa* FOREMAN 1963 GSWA F44038 (150 μm).
Fig. 13. *Helioentactinia stellaepolus* n. sp. GSWA F44042 (200 μm).
Fig. 14. *Entactinosphaera echinata* (HINDE) GSWA F44046 (200 μm).
Fig. 15. *Entactinosphaera* ? *robusta* n. sp. (holotype) GSWA F44045 (180 μm).
Fig. 16. *Haplentactinia rhinophyusa* FOREMAN 1963 GSWA F44043 (100 μm).
Fig. 17. *Helioentactinia stellaepolus* n. sp. GSWA F44048 (90 μm).
Fig. 18. *Helioentactinia aster* n. sp. GSWA F44049 (140 μm).
Fig. 19. *Somphoentactinia cavata* n. sp. (holotype) GSWA F44050 (105 μm).
Fig. 20. *Spongentactinella abstrusa* n. sp. (holotype) GSWA F44051 (160 μm).

Plate 6

Entactinid radiolarians from the Pillara Range, Canning Basin, Western Australia.
(Size of 16 mm scale bar indicated for each figure in parentheses)

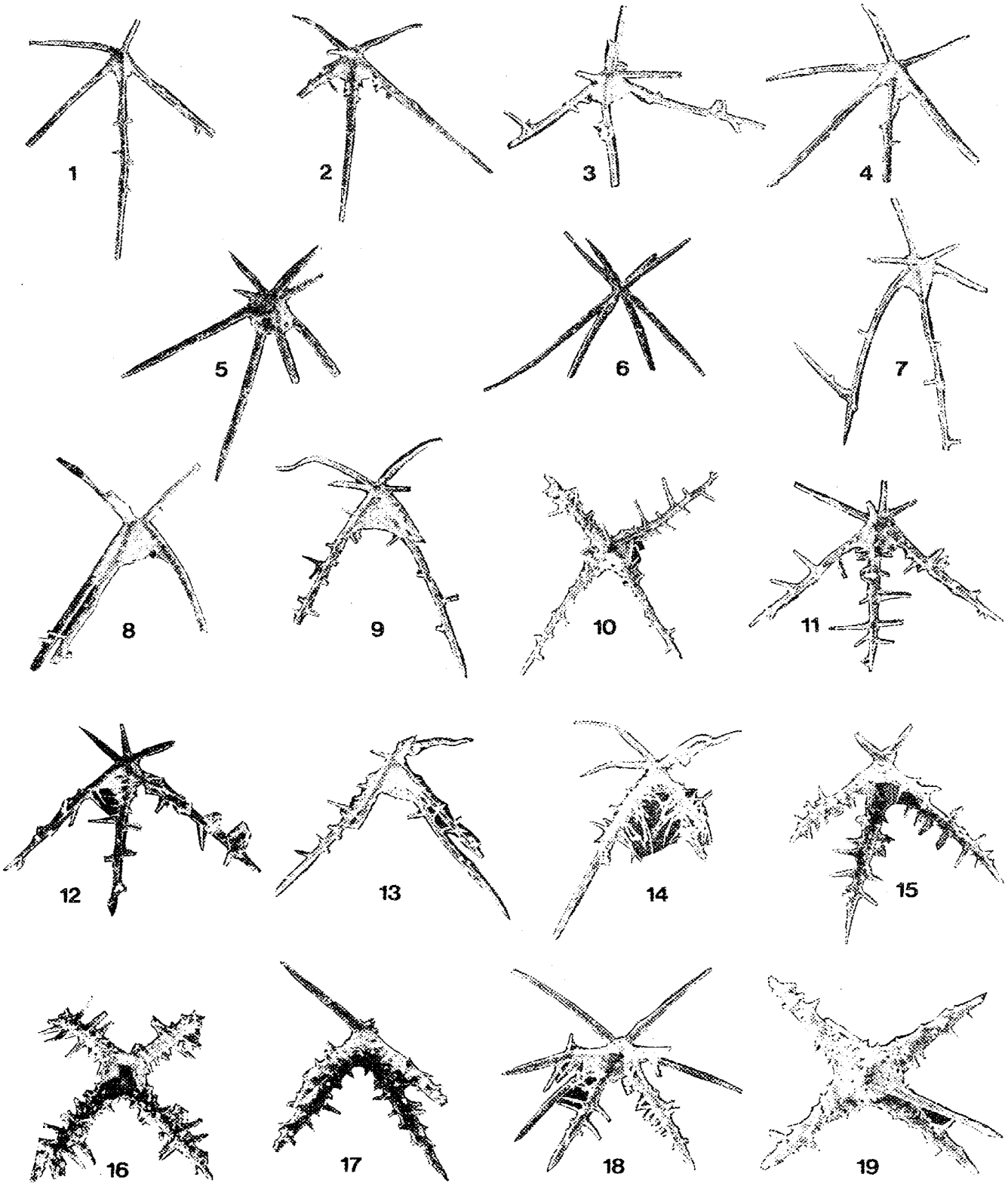
Fig. 1. *Entactinia proceraspina* n. sp. (holotype) GSWA F44052 (160 μm).
Fig. 2. *Entactinosphaera* cf. *E. assidera* Nazarov 1975 GSWA F44053 (140 μm).
Fig. 3. *Haplentactinia rhinophyusa* FOREMAN 1963 GSWA F44054 (120 μm).
Fig. 4. ?*Astrientactinia stellata* NAZAROV 1975 GSWA 44055 (110 μm).
Fig. 5. *Entactinia proceraspina* n. sp. (holotype) GSWA F44052 (33 μm).
Fig. 6. *Entactinosphaera* cf. *E. assidera* NAZAROV 1975 GSWA F44054 (50 μm).
Fig. 7. *Haplentactinia rhinophyusa* FOREMAN 1963 GSWA F44054 (33 μm).
Fig. 8. *Haplentactinia rhinophyusa* FOREMAN 1963 GSWA F44055 (20 μm).
Fig. 9. *Polyentactinia invenusta* n. sp. GSWA F44056 (160 μm).
Fig. 10. *Spongentactinia concinna* n. sp. (holotype) GSWA F44057 (105 μm).
Fig. 11. *Spongentactinia exquisita* n. sp. (holotype) GSWA F44058 (140 μm).
Fig. 12. *Helioentactinia perjucunda* NAZAROV & ORMISTON 1983 GSWA F44058 (100 μm).
Fig. 13. *Spongentactinella intracata* n. sp. GSWA F44060 (100 μm).
Fig. 14. *Spongentactinella intracata* n. sp. GSWA F44060 (33 μm).
Fig. 15. *Spongentactinella intracata* n. sp. GSWA F44061 (120 μm).
Fig. 16. *Spongentactinella intracata* n. sp. (holotype) GSWA F44061 (55 μm).

Plate 7

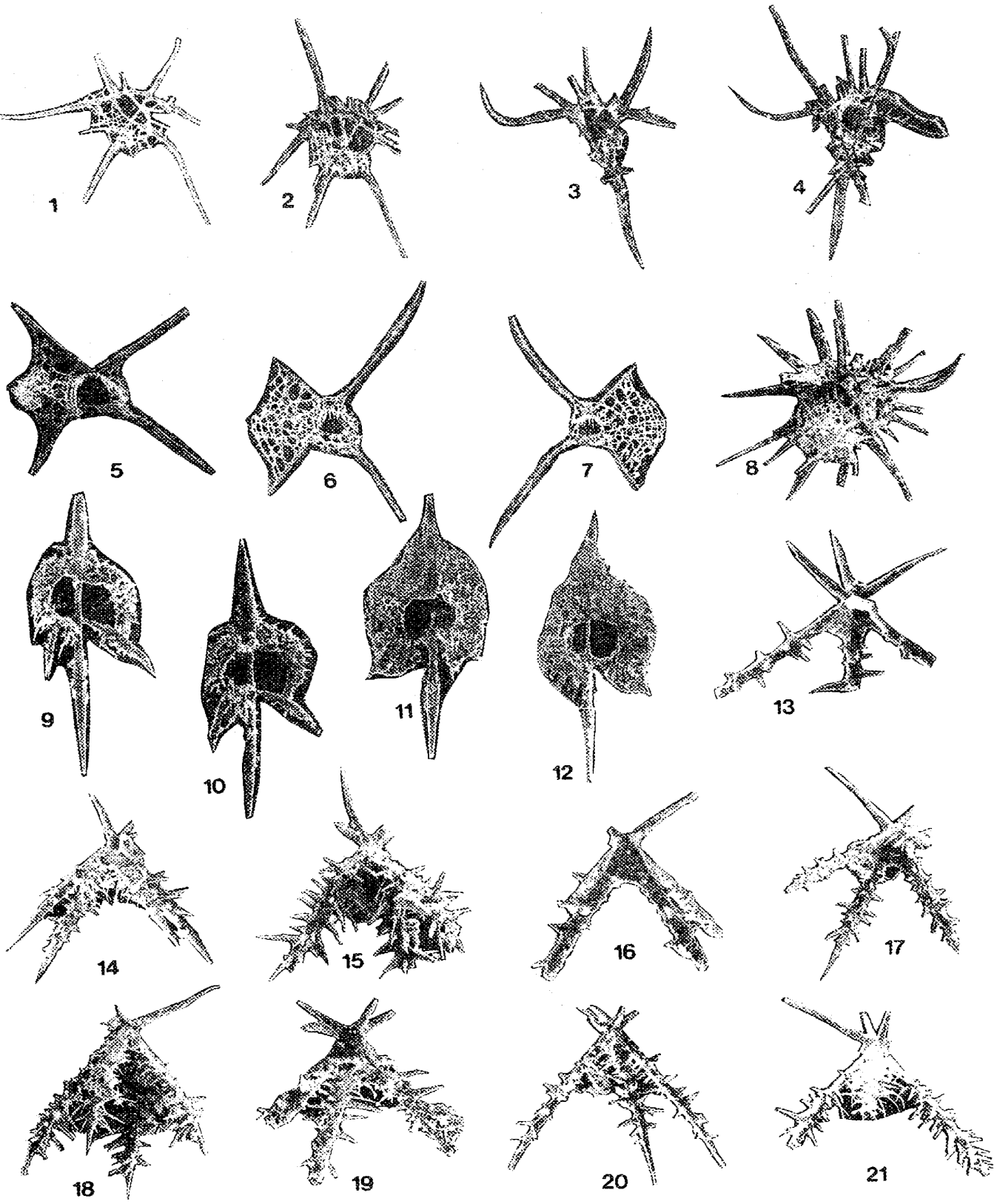
Entactinid radiolarians from the Pillara Range, Canning Basin, Western Australia.
(Size of 16 mm scale bar indicated for each figure in parentheses)

Fig. 1. *Entactinia proceraspina* n. sp. GSWA F44069 (240 μm).
Fig. 2. *Polyentactinia tenera* n. sp. GSWA F44070 (50 μm).
Fig. 3. *Entactinosphaera echinata* (HINDE) GSWA F44007 (200 μm).
Fig. 4. ?*Entactinia* sp. 1 GSWA F44072 (150 μm).
Fig. 5. ?*Spongentactinella* sp. 1 GSWA F44073 (200 μm).
Fig. 6. *Entactinia pillaraense* n. sp. (holotype) GSWA F44066 (100 μm).

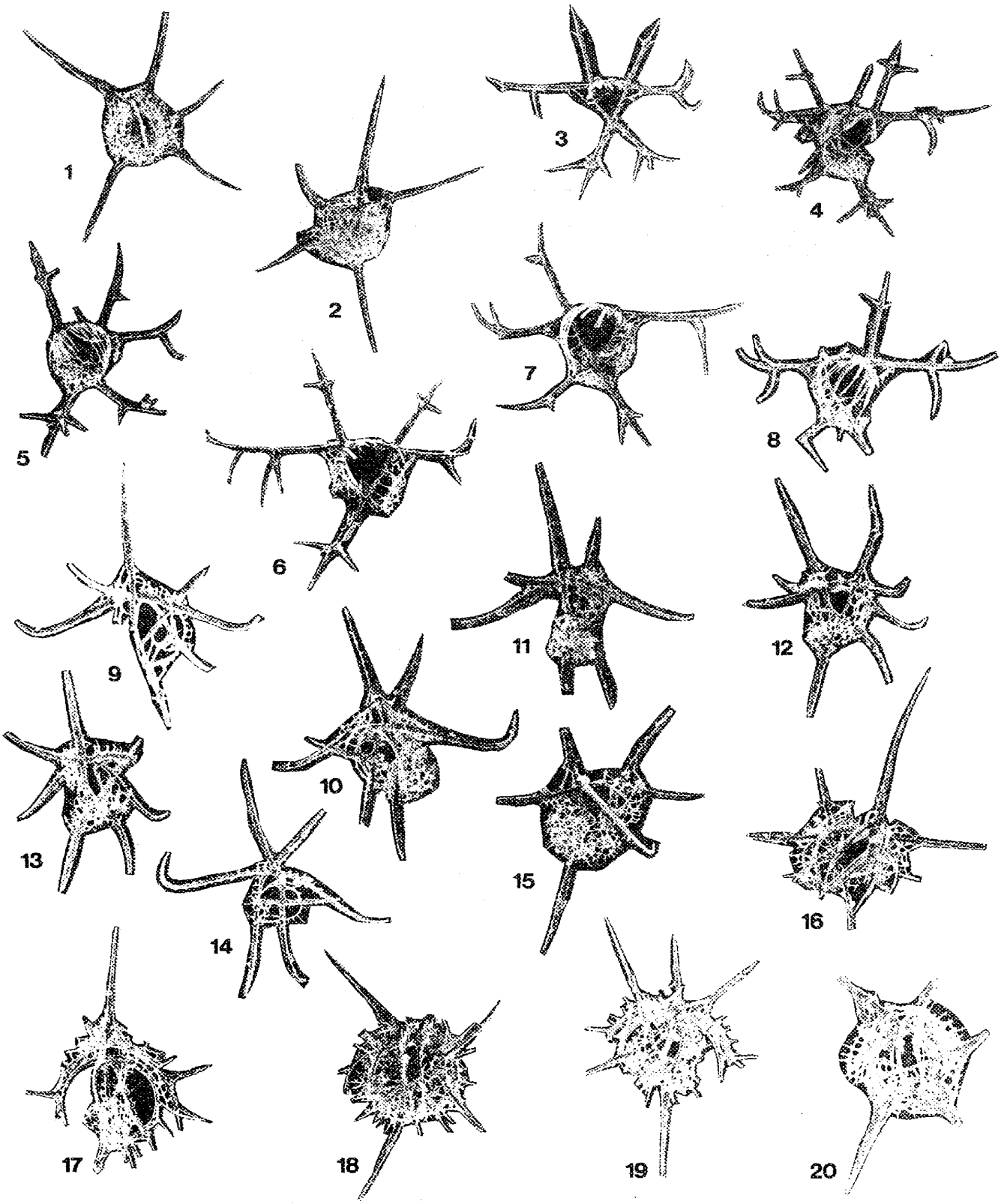
Fig. 7. *Entactinia profundisulcus* n. sp. GSWA F44067 (100 μm).
Fig. 8. *Entactinia profundisulcus* n. sp. (holotype) GSWA F44068 (150 μm).
Fig. 9. *Entactinia aperticuva* n. sp. GSWA F44071 (110 μm).
Fig. 10. *Secuicollacta labyrinthica* n. sp. (holotype) GSWA F44076 (65 μm).
Fig. 11. *Haplentactinia rhinophyusa* FOREMAN 1963 GSWA F44074 (140 μm).
Fig. 12. *Secuicollacta araneam* n. sp. (holotype) GSWA F44079 (75 μm).
Fig. 13. ?*Astroentactinia radiata* n. sp. (holotype) GSWA F44080 (90 μm).
Fig. 14. *Polyentactinia tenera* n. sp. (holotype) GSWA F44077 (140 μm).
Fig. 15. *Entactinosphaera aculeatissima* n. sp. (holotype) GSWA F44078 (200 μm).
Fig. 16. *Helioentactinia aster* n. sp. (holotype) GSWA F44082 (90 μm).
Fig. 17. *Helioentactinia stellaepolus* n. sp. (holotype) GSWA F44081 (110 μm).
Fig. 18. *Polyentactinia tenera* n. sp. GSWA F44075 (160 μm).
Fig. 19. *Polyentactinia invenusta* n. sp. (holotype) GSWA F44083 (160 μm).



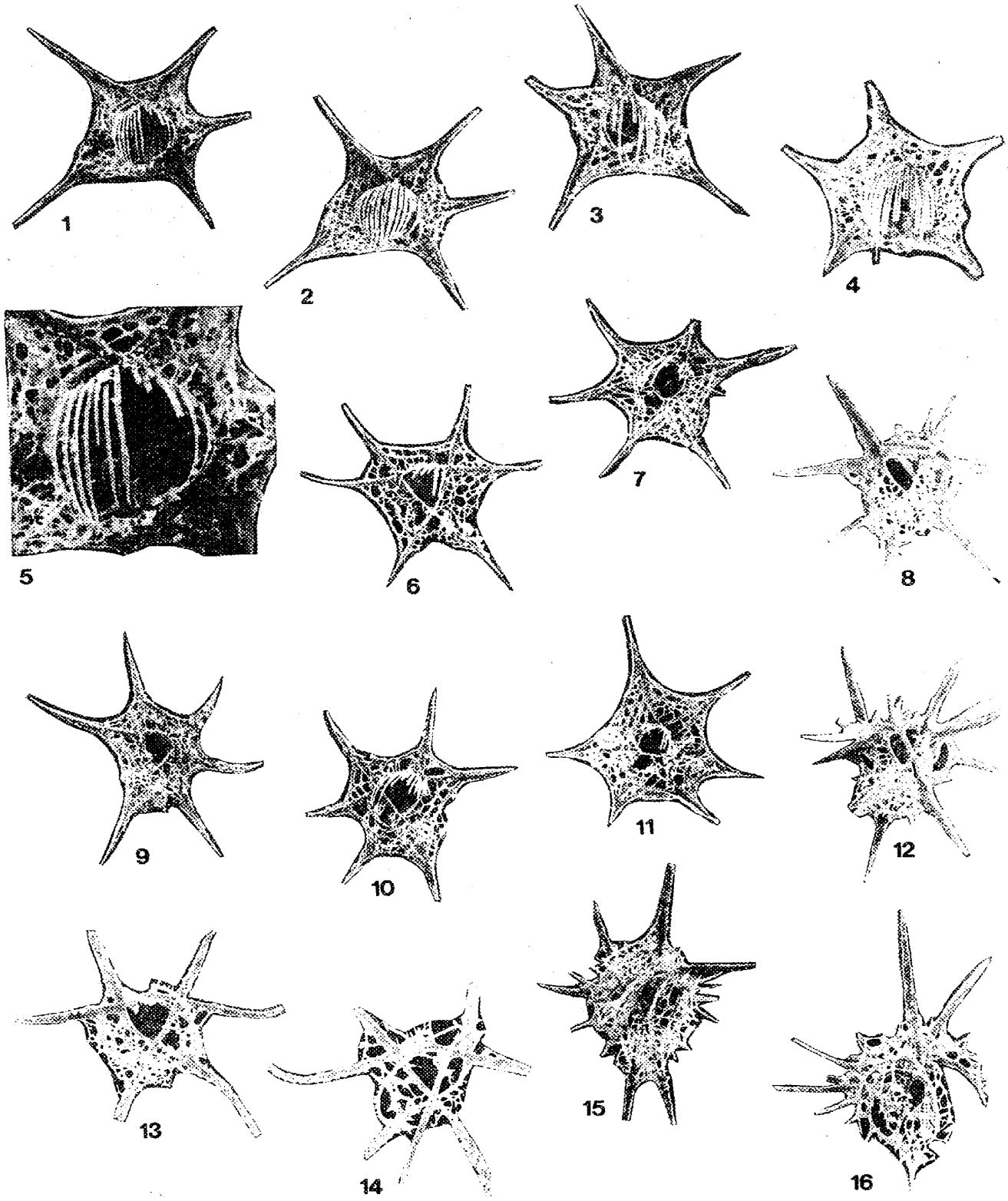
Jonathan C. Aitchison: Devonian (Frasnian) radiolarians from the Gogo Formation.



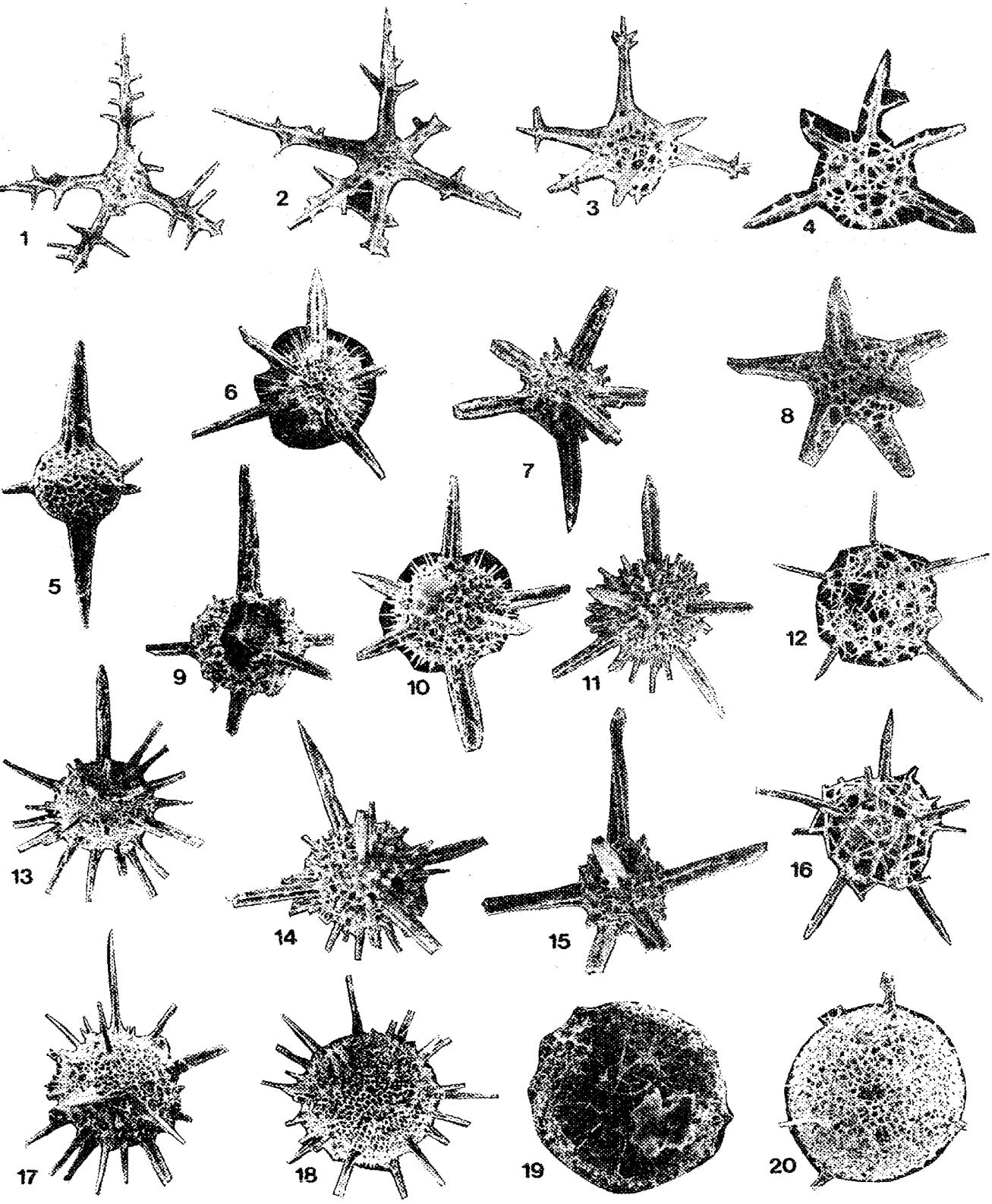
Jonathan C. Aitchison: Devonian (Frasnian) radiolarians from the Gogo Formation.



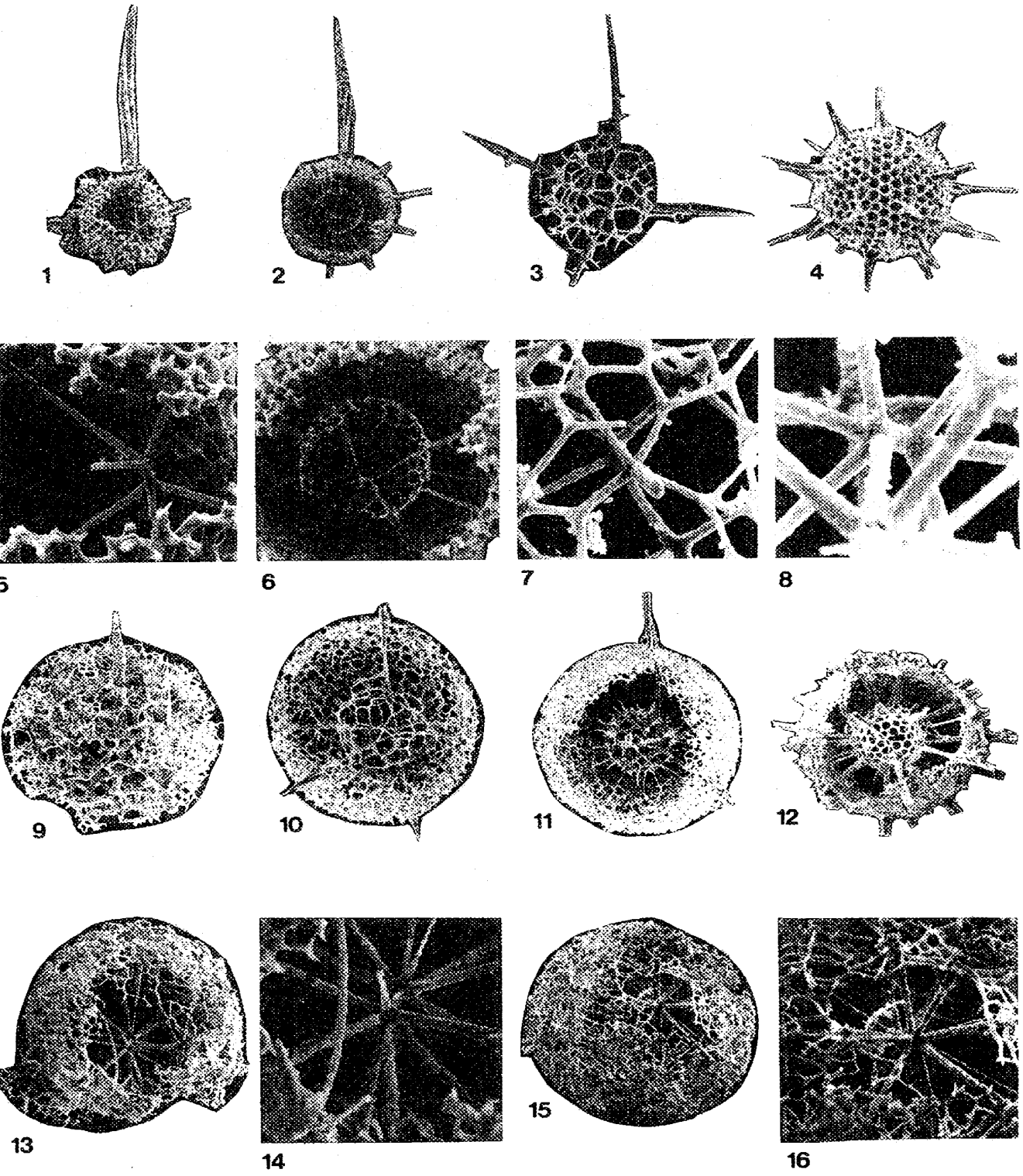
Jonathan C. Aitchison: Devonian (Frasnian) radiolarians from the Gogo Formation.



Jonathan C. Aitchison: Devonian (Frasnian) radiolarians from the Gogo Formation.



Jonathan C. Aitchison: Devonian (Frasnian) radiolarians from the Gogo Formation.



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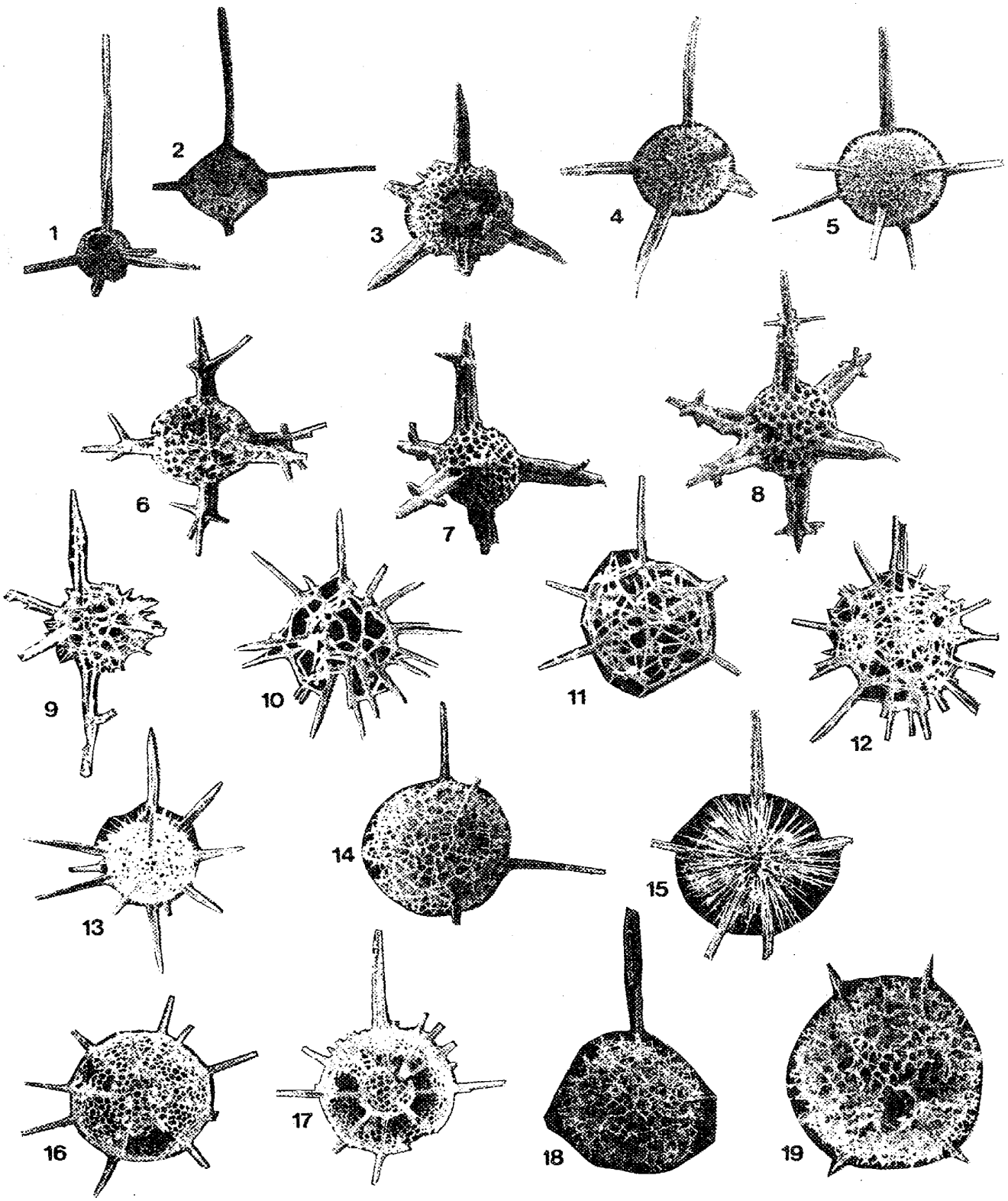

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